CONSERVATION

IN

EASTERN ONTARIO

DEPARTMENT OF PLANNING AND DEVELOPMENT

In politics we have so firm a faith in the manifestly unknowable future that we are prepared to sacrifice millions of lives to an opium smoker's dream of Utopia or world dominion or perpetual security. But where natural resources are concerned, we sacrifice a pretty accurately predictable future to present greed. We know, for example, that if we abuse the soil, it will lose its fertility, that if we massacre the forests, our children will lack timber and see their uplands eroded, their valleys swept by floods. Nevertheless, we continue to abuse the soil and massacre the forests. In a word, we immolate the present to the future in those complex human affairs, where foresight is impossible; but in the relatively simple affairs, of nature, where we know quite well what is likely to happen we immolate the future to the present. "Those whom the gods would destroy they first make mad."

—ALDOUS HUXLEY, Time Must Have A Stop.

(Over the page) South Nation River in flood—rescuing stock at Salter's Bridge.

(Courtesy of Mrs. Frank Salter, Inkerman.)

DEPARTMENT OF PLANNING AND DEVELOPMENT

Hon. Dana Porter, Minister

A. H. Richardson, Chief Conservation Engineer

CONSERVATION

IN

EASTERN ONTARIO

Papers and proceedings of the Conference on Conservation in Eastern Ontario held at Queen's University, Kingston, Ontario, February 2nd and 3rd, 1945.

ONTARIO

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DEPARTMENT OF PLANNING AND DEVELOPMENT

CONSERVATION BRANCH

A. H. RICHARDSON, M.A., S.M.Silv., F.E.,
Chief Conservation Engineer.

C. E. BUSH, B.A.Sc., O.L.S., A.L.S., D.L.S.,
Hydraulic Engineering.

A. S. L. BARNES, B.Sc.F.,
Forestry.

LESLIE LAKING, B.S.A. (Kew Graduate),
Soils.

K. M. MAYALL, B.Sc.F.,
Wildlife and Recreation.

First edition—3,000 copies—1946


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OTTAWA RIVER
ST LAWRENCE RIVER
NIAGARA RIVER
THAMES R.
LAKE ST CLAIR
PROVINCE OF ONTARIO
DEPARTMENT OF PLANNING AND DEVELOPMENT
Map of
SOUTHERN ONTARIO
Showing
PRINCIPAL RIVERS AND DRAINAGE AREAS
Scale
25 0 25 50 75 100

INTRODUCTION

A Conference on Conservation in Eastern Ontario was held at Queen's University, Kingston, Ontario, on February 2nd and 3rd, 1945, by the Department of Planning and Development, in order to discuss problems connected with conservation in that part of Southern Ontario east of the City of Belleville. Invitations to attend the conference were sent to all municipalities in the area, educationalists, government officials, engineers, etc., as well as executives of all organizations of the province interested in conservation. The registered attendance was two hundred and fifty.

The conference commenced on Friday, February 2nd at 2.30 p.m., the delegates being welcomed by the Honourable Dana Porter, Minister of the Department of Planning and Development, Dr. R. C. Wallace, Principal of Queen's University, and His Worship C. L. Boyd, Mayor of the City of Kingston. Dr. G. B. Langford, Director of the Department of Planning and Development, was chairman for the first session at which the following papers were presented: "Conservation in Southern Ontario" by Professor R. F. Legget, "Utilization of the Fish and Game Resources of Ontario" by Professor W. J. K. Harkness, and "The Need for Urban and Rural Co-operation in Conservation" by W. H. Porter.

At 7.00 p.m., the delegates were tendered a complimentary banquet by the Department of Planning and Development in the University Gymnasium at which Dr. E. H. Graham, Chief of the Biological Division, U.S. Soil Conservation Service, Washington, D.C., was guest speaker. Dr. Graham's address was illustrated with kodachrome still pictures followed by motion picture films describing water power, wildlife, modern methods of farm tillage, and kindred subjects.

At the Saturday morning session, Mr. H. S. Arkell, Britannia Heights, was chairman, at which the following papers were presented: "Forest Regions of Southern Ontario" by G. M. Dallyn, "Domestic Water Supply: Urban and Rural Problems" by Dr. John Wyllie, and "Natural Regions in Eastern Ontario" by Dr. D. F. Putnam.

At noon on Saturday a complimentary luncheon was tendered to the delegates by Queen's University in the University Gymnasium, the programme being in charge of the Ontario Conservation and Reforestation Association. The President, Dr. J. H. Munro, Maxville, was in the chair. The speaker on this occasion was Dr. R. C. Wallace, Principal of the University, following which Mr. Harry Sirrett, Brighton, Chairman

of Zone 4 of the Ontario Conservation and Reforestation Association, presented Dr. Wallace with a leather-bound volume of the Ganaraska Report.

Mr. M. C. McPhail, Principal of the Kemptville Agricultural School was chairman for the Saturday afternoon session at which the following papers were presented: "The South Nation River and Its Environs" by Ferdinand Larose, and "Soil Conservation Practices" by L. R. Webber.

All the above papers, including Dr. Wallace's address at the Saturday noon luncheon, will be found in the body of this publication in the order in which they were given.

An interesting feature of the Conference was an exhibition of approximately 100 photographic enlargements, maps, bulletins, books, kindly loaned by Government Departments, Universities and delegates. These were studied carefully by the delegates and helped to supplement the information which was presented by the various speakers.

—A.H.R.

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Mr. A. H. Richardson, Chief Conservation Engineer, Department of Planning and Development (Chairman).

Dr. Harvey Agnew, Associate Secretary, Canadian Medical Association, Toronto.

Professor A. F. Coventry, Department of Zoology, University of Toronto, Toronto.

Mr. G. M. Dallyn, Executive Secretary, Canadian Geographical Society, Ottawa.

Professor R. O. Earl, Dean of Arts, Queen's University, Kingston.

Mr. James Farrington, Assistant Deputy Minister, Department of Game and Fisheries, Toronto.

Professor W. J. K. Harkness, Director of the Ontario Fisheries Research Laboratories, University of Toronto.

Dr. Otto Holden, Chief Hydraulic Engineer, Hydro-Electric Power Commission of Ontario, Toronto.

Dr. M. E. Hurst, Provincial Geologist, Department of Mines, Toronto.

Mr. R. N. Johnston, Chief of the Division of Research, Department of Lands and Forests, Toronto.

Professor R. F. Legget, Department of Civil Engineering, University of Toronto, Toronto.

Mr. J. E. McCague, President Holstein-Friesian Association, Alliston.

Professor E. G. Pleva, Department of Geography and Geology, University of Western Ontario, London.

Professor G. N. Ruhnke, Director of Soil Surveys, Ontario Agricultural College, Guelph.

REGIONAL COMMITTEE ON LOCAL ARRANGEMENTS

Dr. R. C. Wallace, Principal, Queen's University.

Dr. R. O. Earl, Dean of Arts, Queen's University.

Mr. A. H. Richardson, Chief Conservation Engineer, Department of Planning and Development.

Mr. J. R. Dickson, Forest Engineer, Department of Mines and Resources, Ottawa.

Mr. Ferdinand Larose, Agricultural Representative, Plantagenet.

Mr. R. B. Ness, Farmer, Portsmouth.

Mr. J. R. Henderson, Farmer, Portsmouth.

Mrs. D. W. Boucher, Ontario Horticultural Association (Hill and Traymoor Streets, Kingston).

Mr. A. W. Sirett, Agricultural Representative, Kingston.

Mr. W. Austin Peters, Kingston Rod and Gun Club, R.R. No. 1, Kingston.

Mr. A. B. Wheatley, Zone Forester, Department of Lands and Forests, Kemptville, Ontario.

Dr. J. H. Munro, President, O.C.R.A., Maxville, Ontario.

Dr. H. W. Curran, Department of Biology, Queen's University.

I

ADDRESS OF WELCOME

Principal R. C. Wallace
Queen's University

It is a great pleasure for us at Queen's to have you here, not only for yourselves, but because of what you represent—an interest in the conservation and development of our natural resources, and particularly this Eastern Ontario area.

We, at Queen's, are very much interested. We feel we have a responsibility because we live in this area, and we have departments, scientific departments, which are concerned about these resources and have already done some considerable work in that field.

So, when we knew that the Government, the Department of Planning and Development, had decided to have a conference in Eastern Ontario, similar to that in Southern Ontario, we asked if they might be willing to have it here at Queen's, and we are very pleased that they agreed to do so. I know that it will be stimulating to us and we hope that the surroundings and the conditions of the University will be helpful in that there are many things you may want to see if you have time, even apart from the Conference.

We can only say to you if there is anything at all that you want, or anything that is not satisfactory, Dean Earl or Miss Healey or myself will be glad to try to look after it right away.

We have tried to make the conditions as simple and as easy as possible so that you don't need to leave these surroundings at all until all the matters of the day are over after the dinner. The session may go on fairly well on to dinner time, and the gymnasium is very near here, so you will have no trouble about going back to the hotel and coming back here.

I have to speak briefly to-morrow at the Luncheon so I am not going to take the time now, but I can only say we would be neglectful of our responsibility and duty as a University if we did not feel that conservation and the safeguarding of our resources generally throughout our country, and particularly in our own area, is one of our major responsibilities as Universities to-day.

It is for that reason that we welcome very heartily indeed this Conference. I know it is going to be good from the quality of the programme, and I know that it will be helpful to us in Queen's, and I know it will be helpful to all of you. We welcome you here.

I am particularly happy to welcome you on account of the purpose for which you have come. I am a very strong believer in the necessity for conservation. The case for conservation is very pungently put in that paragraph on the opening page of your programme.

The need for conservation can be seen by going within a few miles of this city, and I believe almost any city in Ontario. Conservation is something about which the individual himself can do very little. For that reason I am very, very pleased that our Government has seen fit to establish a Department which has taken up this subject. While it is called the Ontario Department of Planning and Development, they have taken up the matter of conservation. I consider the establishment of that Department one of the finest things that any Government has done. It shows more imagination than we are accustomed to seeing in a good many matters of government, and I am very pleased that the Department which has been set up is showing imagination in the way it is carrying on its duties.

I am grateful to Queen's University, whose facilities make it possible for you to gather here, and I wish to thank them. I assure you of your welcome. I hope your deliberations will be very successful.

The Honourable Dana Porter
Minister, Ontario Department of Planning and Development

Many people have some strange notions as to the function of the Department of Planning and Development. I suppose during the first few months of our existence we threw away about ninety per cent of the proposals that were placed before us.

Our job under the statute which set us up is to formulate plans, and to devise ways and means for the productive employment of the human and material resources of the Province. It became very apparent, when we had an opportunity of making certain broad investigations and taking stock of the position of this Province, that there were certain fundamental needs which could only be met by a planned development. One of those fundamental needs which had never been fully tackled before was the conservation, restoration and development of our natural resources. That is the reason why a conference was called in London recently. That is why this conference has been called here to-day.

One of the essential features of any programme of conservation is the educational aspect of it. Unless the people gradually begin to understand what it implies, no planning from any central authority will be able to achieve the result that we must set out to achieve during the years ahead.

Therefore, we feel highly gratified at the response with which these two conferences have been met. I am convinced that in this way we can begin to lay a foundation for the employment of our natural resources. Any talk of employment is futile unless we can think of ways and means for productive and useful employment of the men and women and the natural resources of this country in the postwar years.

WELCOME TO THE CITY OF KINGSTON

His Worship Mayor C. L. Boyd

I am happy to be able to welcome on behalf of the City of Kingston, you who are attending this Conference on Conservation. I can assure you that your welcome is just as warm as the welcome extended by those cities in which keys to the city are handed to the visitors. Unfortunately, Kingston does not give out keys to the city. We have a number of people who come here whose freedom has to be conserved and for that reason the Mayor has not the discretionary power of giving out keys, but I can assure you when it comes time that you must go that there will be no hindrance placed in the way of your departure and you won't need the keys to get out.

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"CONSERVATION IN SOUTHERN ONTARIO"

Professor R. F. Legget,
Department of Civil Engineering, University of Toronto

FROM the windows of this time-honoured building, it is possible to look across the waters of the great River, now fast bound in ice, and to see the undistinguished outline of the little island which seems to shelter in the lee of Wolfe Island, that quiet spot bearing the lovely name of Garden Island. Long the favourite of many Kingstonians, and long remembered by all who have visited it, Garden Island is to-day a summer haven well worthy of its name, quiet and peaceful in its pleasant isolation. But to the visitor with the seeing eye, signs there are still of a very different past, signs which point to the eighty years during which the island was a place of commerce, maintaining a busy and active community, shipping its goods to the four corners of the earth.

Its commerce centred about one commodity only—wood; spruce wood, white pine, oak and other hardwoods of the east, big wood, small wood, but chiefly the squared timbers still familiar in old prints and stories. The wood came from the nearby forests, a good deal from the forests of Wolfe Island, to-day known only for its farms. Millions of board feet of some of the finest timber ever seen passed through the books of the Garden Island owners, were rafted together in the waters of the bay, and started on their long journey by an adventurous trip down the rapids of the St. Lawrence under the expert guidance of the "river men". Even a full rigged ocean going sailing ship was built on Garden Island of local timber, with her mainmast 128 feet above the deck! Launched on 8th May, 1877, and named the Island, the vessel was fitted out in Quebec City and then sailed the seven seas until wrecked in 1906 or 1907.

Rafting of timber on Lake Ontario gradually declined until, by the turn of the century, Garden Island was left as the only rafting centre. And its last raft went down the rapids in 1911, all commerce ceasing on the Island in 1914, just over thirty years ago. To-day, the gaunt remains of the Island's wharves, and the lingering memories of an older generation point with no uncertain finger to the subject of this conference—the conservation of renewable natural resources in eastern Ontario.

For the history of Garden Island is no unusual record. It typifies the attack on the forests of Ontario, an attack which gave no thought to

the morrow, an attack which regarded timber as something to be mined from its natural habitat, to be sold if at all possible. Think of the strange story of the Rideau Canal and of its hey-day of activity when even a branch canal was built (to Perth) in the interests of the timber trade: think of its quiet and lovely waters in summertime now, disturbed only occasionally by a lazy paddle from an itinerant canoe. Think of Port Hope, once the rival of Toronto as a great shipping port, through whose harbour passed fifty million board feet of squared timber in the year 1879. Think of these things, of some of the abandoned farms you know, and you will appreciate why such a conference as this is being held.

Let us, however, be quite clear in our minds about our purpose in gathering together within these ancient and hospitable walls. We are not here to bemoan the past. Nor shall we cast aspersions on the work of the pioneers who opened up this land by labour we can still admire, under primitive conditions we would do well, sometimes, to recall. They did as best they knew. We honour them, even as we consider how we may best profit by their mistakes and as we plan to do our part in making this land the place they must often have pictured in their dreams.

We are thinking together of the great area known generally as eastern Ontario, politically integrated but containing three distinct natural regions. To the north and east we have the great valley of the Ottawa River, gradually flattening as the river nears its junction with the St. Lawrence, and approaching so closely to the north bank of the great river that we can think of most of the eastern end of the province as Ottawa Valley country. To the south and west, the rolling country of south central Ontario gradually narrows as it is bounded by the Pre-cambrian Shield and the shores of lake and river. The watersheds of the Trent, the Ganaraska, the Moira, the Napanee and the intervening streams constitute a series of those integrated river valley units so typical of southwestern Ontario.

The Cataraqui and Rideau Rivers, now linked by man, form a thin silver link between these two distinct natural regions, bridging the third region, the Pre-Cambrian Shield which forms, as it were, a great wedge thrust from the north between the two drift-covered regions of agricultural development. It is, of course, in this third area that the remarkable mining developments of the region have taken place. Although admittedly natural resources, the products of the mine are not renewable, and so they will not come up for consideration at this conference. Problems there are a-plenty in relation to conservation in the mining industry but they are very different from those associated with the so-called renewable resources—the soil, the forests, wildlife, and water, the least appreciated and yet the most important of all.

By A. A. Calvin

Millions of feet of squared timber were built into rafts at Garden and Wolfe Islands and floated to Quebec. Building a raft.

Consider, briefly, the wonderful state of balance amongst these resources achieved by Nature, witnessed in all its glory by the early explorers of this region. They found the forest all prevailing, practically all the land covered by trees except for lush river meadows and swamp lands. The forest was paved with underbrush and litter, that remarkable formation which at once protects the soil and promotes the seepage into the ground of melting snow and dripping rain. Some water would naturally "run-off" directly into streams and lakes, but it is fair to say that most of the rain and snow eventually found its way into the ground, there to replenish the great reservoir of groundwater which alone makes possible the continued flow of springs and streams throughout the year. In the forest, wild-life roamed at will, maintaining its own dynamic balance; in rivers and lakes, fish abounded. Streams, fed by springs and groundwater seepage, flowed steadily; when the snow and ice melted they probably rose in flood but their flow throughout the year was reasonably well regulated. This is the picture, as we have it from early writers, and as it can be still seen to-day in areas as yet undeveloped.

The first settlers arrived, and the assault on the forest began. Trees were cut down at first to provide farming land, later to be sold as timber. And the result? The formation of the many fine and famous farms of eastern Ontario; the opening up of this cradle of Upper Canada and the start of its little towns and villages, its industries and eventually its mines. We can indeed look to this achievement as an important part of the history of eastern Canada. It is a great story, now fortunately

By A. A. Calvin

Rafts of squared timber on their way to Quebec.

recorded for us in many fine books, and so a story that is well known. But—there is another side to the same story, one that is not well known, one not yet recorded in books, with a very notable exception.

In all too many areas, *all* the trees were cut down with no thought of the consequences, no thought of the effect upon the soil, no thought of the suitability of the soil for cultivation, and with never a thought about future crops of trees. And the result? Some of you know. The disappearance of all large scale lumbering from this part of Ontario with all the consequent economic and social waste involved. Cleared land farmed for a few years and then abandoned as unproductive. Virtual disappearance of many forms of wild life. Erosion of unprotected soil, with all the inevitable consequences—spoiled farming land, silted waterways, a great decrease in the hidden reservoir of groundwater, and so dried-up wells, springs that flow no more, and streams that dry up in summer and rise in tragic flood in spring time.

Mark well that these are not isolated phenomena, as so many seem to think, but all are most definitely interrelated. Admittedly, the severity of this defamation of Nature varies throughout the region but there are few parts of eastern Ontario in which this picture is not true to some degree. Possibly the worst local example is provided by the Ganaraska Valley. Many of you will know that there was recently published a Report of a detailed survey of the valley, prepared by Mr. A. H. Richardson, who supervised the survey. This report is a notable document; it should be familiar to you all. It will be discussed later in

this conference and you will see that the picture which I have sketched is mild indeed by comparison with the ravages wrought by man's untutored hand on the valley of that lovely little river, all within but little more than a century.

Despite all the evidence which the Report contains, I am told that there are still residents of Port Hope who do not yet believe that the annual flooding of their pleasant town is due to the devastation of the watershed above. In view of this blindness, for such it is, it is perhaps not surprising that in many ways men have actually aggravated this interference with Nature's balance. Consider just three of these ways. In the subdividing of land, it was an almost invariable practice to lay out boundaries to a chequer board pattern, irrespective of natural features. The result has been innumerable fields of irregular contour. When ploughed in the long accepted standard manner, parallel to the fence lines, furrows have run uphill and down. They still do, and this spring again you will all see the result—the melting snow and ice running down the little channels so thoughtfully provided, to enter stream or pond, instead of being held in place on the good earth, there to sink in

Waste land in Durham County, Ontario—heavily eroded by wind and water.

and replenish the groundwater beneath. And as the little streams flow steadily down these plowed furrows, watch them—and see the top soil they take with them, soil taken away not to be replaced in a thousand years.

If we get a sudden thaw this spring, as is quite probable, the loss of good top soil will be even greater than usual. There may be some amongst you who think that I exaggerate the picture, as you recall the top-soil you know still to be in place, possibly on your own farms. It is true, most fortunately, that the ravages of soil erosion have not yet assumed alarming proportions, except in some areas, but it is, perhaps, the first stages of soil erosion—when its existence is not appreciated—which are the most insidious. A journey by air from here to Toronto along the lake shore on a calm summer's day would, I am sure, convince the most skeptical of you for at the mouth of every stream and river you would see the regular outline of a large cone beneath the blue waters of the lake, a cone of top-soil, washed down from farm-lands above.

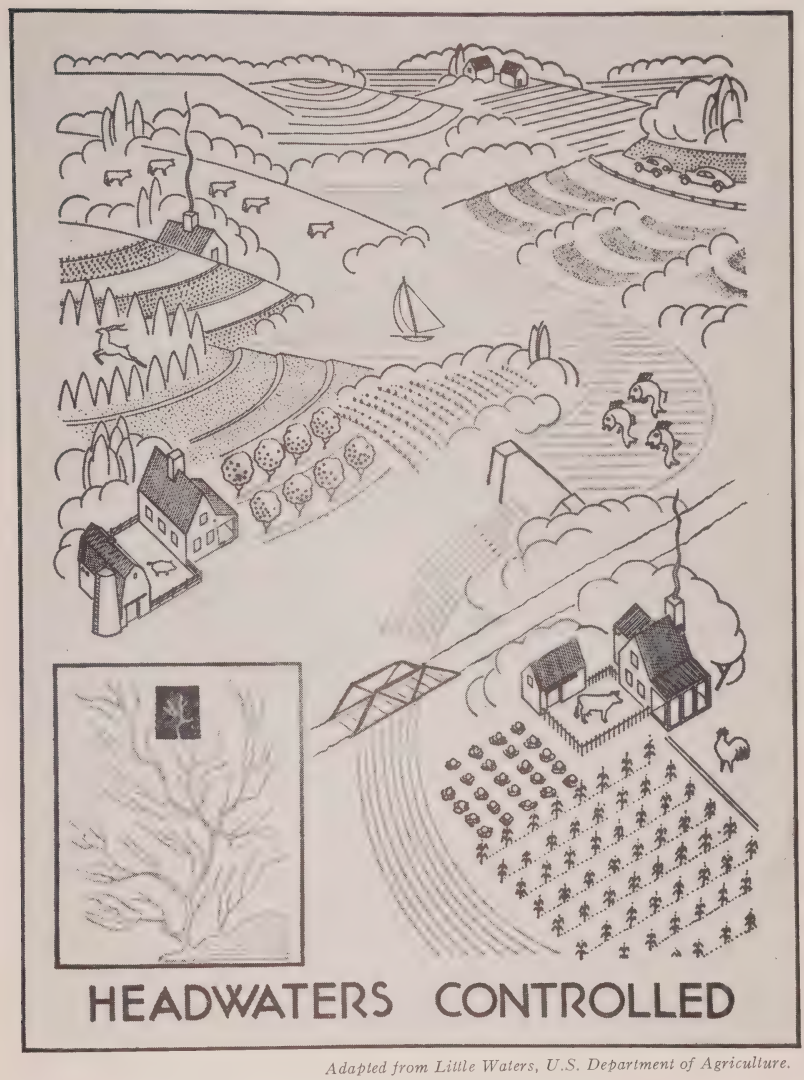
Consider next our drainage laws and practices. Although it is not easy reading, the Municipal Drainage Act is worthy of study by all who are concerned with the future of this land. You will find it in the third volume of the Revised Statutes of Ontario, issued in 1937, Chapter 278, from p. 3751 to p. 3800, fifty pages all told, and *all* concerned with getting water off the land. I can find in it no reference at all to the desirability of keeping water *on* the land. Even when the Act deals with "injury liability", it does so from the point of view of drainage waters flooding lands below the outlet with no mention at all of the damage done by abstracting water unnecessarily from land which vitally needs it. And all water removed down drainage ditches is water which is not being allowed to seep into the ground, there to replenish the great hidden reservoir of ground-water upon which the prosperity of any region ultimately depends.

Even more tragic has been the deliberate interference with stream flow. On most untouched streams, natural ponds and little lakes were to be found and these were very properly used by early settlers to form mill-ponds. Hundreds of water mills dotted this region fifty years ago. How many remain? Some were allowed to fall into disuse. Others were deliberately destroyed. Many of you know the pleasant old mill at Collin's Bay built in 1826; many of you will know the watercourse above it, now dry for all but a few weeks of the year. A mill-pond used to feed the mill and maintain the stream flow, formed by a dam about 1½ miles from the Lake, with a subsidiary dam about ¾ mile upsteam. On a night in 1918, possibly out of political spite, the dam was dynamited. Repaired temporarily, it was dynamited again in 1921, this time beyond

Adapted from Little Waters, U.S. Department of Agriculture.

all hope of repair. The mill stopped working, the ponds gradually drained, and the stream stopped flowing except in flood periods. The same sad and tragic tale can, I believe, be told of the Napanee River. Is it any wonder that the decrease in the groundwater reservoir in this part of the country is now regarded as serious?

I stress the importance of groundwater, and the effect upon our smaller streams of deforestation and improper plowing because there



Adapted from Little Waters, U.S. Department of Agriculture.

are all too many who do not properly appreciate the tremendous importance of these "Little Waters" to the future well-being of eastern Ontario. There are those who will point to the great Ottawa River and the majestic St. Lawrence and deny that there is any water problem in this region. It is true that these two great rivers do flow regularly, the St. Lawrence remarkably so, but this is in practically no respect due to any contributions made by eastern Ontario, the great volumes of water

in these mighty streams being derived from the great watersheds above their confluence.

May I remind you that *every* river derives its flow from the "Little Waters" throughout its watershed, the streams and rills which, although so insignificant in themselves—when joined swell to mighty flood. And these little waters derive their water, except when it is raining, from seepage from Nature's own reservoir, the groundwater stored in the ground. You have all seen some evidence of this reservoir, the water at the bottoms of your wells, the springs on your farms, but because it is a hidden reservoir it is given little thought or study. In the whole of this great Dominion we have no agency at all charged with the duty of watching and recording the fluctuations of the groundwater level, still less of safeguarding its supply. Contrast this sad state of affairs with the newly announced programme of the United States Geological Survey which plans to spend $15,000,000 in the first three post-war years merely on surface and groundwater investigations!

Remembering how closely engineers are associated with the use and control of water, you will perhaps understand now the more readily why it is an engineer who is giving the first paper at this Conference. And perhaps because I am an engineer, I may be permitted to refer in somewhat greater detail to plans for the development of the Ottawa and St. Lawrence Rivers. Many look forward to the early development of water power sites on the two rivers and place all their hopes for the revitalizing and rapid development of this region on the correspondingly anticipated industrial activity. Leaving aside the proposed St. Lawrence Deep Waterway Project, since it is presently in the political arena, let us think for a moment of the proposed Ottawa River developments. You will know how the political boundary up the centre of the river has rendered all considerations of power development unusually difficult. You will, therefore, have rejoiced, as I rejoiced, when it was announced some time ago that after months of tireless effort on the part of engineers and others, agreement had been reached by the provinces of Ontario and Quebec to develop jointly the power resources of the river. Here, at last, was the recognition of nature's own boundaries, the limits of a river valley or watershed, and the subordinating of a political boundary in the interests of the common good. So can we look forward to the gradual development of that great river, stage by stage. There are many who, even now, dream of the Ottawa Valley being the scene of comparable activities to those so magnificently initiated by the Tennessee Valley Authority.

It is a fine parallel and most appropriate to our own thinking about conservation. For the planners of the T.V.A. have not only developed

power, promoted industries and improved navigation, but they have also taken major steps towards flood control, they have initiated wide-spread soil conservation measures, they are assisting with the introduction of sound farming and plowing methods, and in ten years they have done more reforestation than has the Province of Ontario since it started such work thirty years ago. They faced similar problems to those which exist in eastern Ontario; they have gone a long way towards solving them, not by imposing planning from "on top" but by encouraging and assisting local and individual enterprise. They are succeeding because they are men with a vision.

"Where there is no vision, the people perish." So said the prophet of old, truly, as time has shown. It is hoped that you will leave here tomorrow as men and women who have seen a vision. Others more competent than I will depict for you in detail the general picture I have tried to put before you, will show you vivid evidence of the damage that has been done, will demonstrate that remedial measures are possible, are simple, are economical and that they will work. They will show you how perfectly adapted is conservational work for the rehabilitation of those now serving in the armed forces. But you must see this vision for yourself, a vision of what this region yet may be, conforming to Nature's laws and balance, and yet assisting many people to lead here the good life, a vision for the full expression of which we may, with propriety perhaps in this seat of sound learning, turn to Holy Writ wherein we shall find promise of "a good land, a land whose stones are iron and out of whose hills thou mayest dig brass, a land of brooks of water, of fountains and depths that spring out of valleys and hills; a land of wheat and barley and—honey; a land where thou shalt eat bread without scarceness, thou shalt not lack anything in it."

3

"UTILIZATION OF THE FISH AND GAME RESOURCES OF ONTARIO"

Professor W. J. K. Harkness

Director of the Ontario Fisheries Research Laboratories,
University of Toronto

THE purpose of this conference is to plan for the conservation of the renewable natural resources in Eastern Ontario.

The basic value of conservation, which for present purposes may be defined as "The wise use of our renewable natural resources" is to be found in the contribution which it makes to the welfare of mankind. The continuous renewal and maintenance of these resources including fish, game and furbearing animals, along with agricultural and forestry produce, is dependent upon the soil and water conditions.

At the present time we are learning a great deal about the necessity for the conservation of this soil and water and although this is fundamental it is not in itself sufficient to insure maximum production. We cannot hope for the best production until we adapt our crops, be they agricultural, forestry or game and fish to the capabilities of the land and water, nor until we employ such management methods as will utilize and conserve the potential producing capacity of these basic necessities, soil and water.

The basic importance of agriculture to the welfare of any country gives it precedence in the utilization of those lands best suited to its requirements. Recent analysis makes it quite clear that many areas which are, or until recently, have been devoted to agricultural use, would produce much more valuable crops as forest or woodlot. Under these conditions they would be eminently suitable for the production of game and by the direct influence which this change in usage would have upon the water supply, the conditions for fish production would be vastly improved.

Such modification in the use of the marginal agricultural land of eastern Ontario coupled with improved agricultural practices will have multiple values. It will augment the crops from agricultural land and bring the marginal land into useful production of trees, fish, game and furbearing animals as well as increasing its value for recreational purposes.

The potential possibilities for the complete development of the natural resources of eastern Ontario present a challenge to the best

By E. B. Murdoch

An Ontario Farm Fish Pond on the property of Mr. H. M. Rittenhouse, Beamsville, Ontario, established over sixty years.

interest and ability of the citizens of this area. Here we find large continuous tracts of the best agricultural land and of land suitable for forests, game and recreation. There many areas in which good agricultural land is immediately adjacent to marginal land best employed for purposes other than agriculture. There are also large areas of water from the smallest spring fed streams, drainage creeks and farm ponds to great rivers and lakes such as the Ottawa and St. Lawrence Rivers, Lake Ontario and the lakes of the Rideau system.

In order to achieve the best possible use of these land and water areas there must be an integration among agricultural and forestry practices, the production of fish, game and fur-bearing animals and the use of land for recreational and tourist interests. Within an overall integral unit special attention must be given to the development and maintenance of each field of production as within itself, in order to implement to the highest degree the utilization of the soil and water in the area.

By U.S. Soil Conservation Service.

A good farm pond will supply food and fun, boating, swimming and fishing. Well stocked and cared for, it becomes a valuable possession.

The areas of forest, water and marginal agricultural lands are of outstanding value for the production of game, fish and fur-bearing animals as well as for recreational and tourist use. The agricultural lands also when wisely developed, have high potential game and fish producing possibilities, which when wisely integrated benefit the farmers both through stabilization of soil conditions and the addition of game as an asset. The possibilities offered for the adequate and most useful development of the game, fish and fur-bearing resources of eastern Ontario are so vast and valuable that I consider it a very great privilege as well as a serious responsibility to be invited to give direction for the effective development and utilization of these resources.

At the Conference on Natural Resources held in Kingston on April April 30th, 1943, Mr. H. H. MacKay presented the situation with respect to the game and fish resources of this area with great clarity, and at the more recent Watershed Conference in London, Professor A. F. Coventry emphasized the close relation between the conditions of the fish and

game and the well being of any area pointing out that a proper proportion of game habitats is an essential feature of a healthy countryside.

This afternoon I propose to develop the theme of these papers in the direction of more concrete consideration of methods directed toward the development and best use of the fish, game and fur-bearing animals throughout eastern Ontario. Referring to my previously stated basic principle, this development demands that land and water areas be used for the production of the best kinds of fish, game and fur-bearing animals that they will sustain. Visualizing the continuous production of the most valuable crops this usage must be compatible with the best available overall land and water use.

I should like to be specific with respect to definite concrete suggestions for the treatment of particular lakes and rivers and tracts of land for the production of fish, game and fur-bearing animals, but there is so much variation between the conditions existing in different bodies of water and on different tracts of land that it is quite impossible to be specific in dealing with such a large area as that encompassed by eastern Ontario. So although I shall make definite recommendations for the development of water and land areas the specific details must arise from the application of these recommendations.

Our present information is in general sufficient to tell us the kind and amount of fish and wildlife each water and land area may be expected to produce. If each such area is not producing the most desirable species in what may be considered adequate quantity, steps need to be taken to rectify this condition either by the use of other species or by modification of the water and land conditions and use.

Here a warning may be sounded against indescriminate use of artificially reared fish or game birds, particularly if they are not native to the specific area under management. Much harm may be done by the introduction of foreign species if they are in any way antagonistic to the native species and it is most undesirable to release hatchery produced fish or game birds in thoroughly unsuitable surroundings. The desirable alternative is the creation of conditions which will be increasingly favourable to wild life. This action will have the double value of favouring the increase of the local fish and game population as well as assuring establishment and maintenance of desirable stocks of fish and game birls released from hatcheries.

It is certainly unnecessary to state before this audience so well versed in the general relations of wildlife, that fishes require more than water, although this fact, almost a truism, is not perhaps generally recognized. Each species has special requirements with respect to such

conditions as food and temperature. Different living conditions are required by such different species as trout, bass and maskinonge, even the distinct species of trout and bass each needing particular conditions.

In a parallel fashion lakes and streams vary in their potential capacities to produce useful crops of fish, just as the land areas vary in their capacity to produce agricultural, forestry and wildlife crops.

In planning a managed fish production it is necessary to classify the waters on the basis of their physical, chemical and biological composition, just as land is classified on a geological and soil basis. Mr. MacKay presented such a classification for certain eastern Ontario waters with his paper at the Kingston Conference in April, 1943.

We find on the basis of such a classification that some lakes are shallow, others are deep, while others may have various amounts of deep and shallow water with the shallow water for the most part being near the shore. A common characteristic of lakes is that the shallow water is warm in summer while the deep lakes or deep parts of lakes become thermally stratified with the deep water remaining cold during the whole summer season. If these areas of deep cold water are small they will become devoid of oxygen and so uninhabitable by fish. If, on the other hand, they are of relatively large size, the deep water will serve as the summer home for such cold water loving fish as the trout, whitefish, lake herring and ling.

On this basis we can classify our lakes as those which will produce only warm water fish such as bass, sunfish, perch or catfish, and those which will produce cold water fish such as the trout. In general deep lakes have shallow water areas near shore so they may have the dual capacity of producing both warm water fish and cold water fish.

A further division of shallow water lakes may be made on the basis of those which are so small as to be generally considered as ponds. We find that, in general, these are unfavourable for such fish as the smallmouth black bass, but favourable for certain other species such as catfish, carp and bluegill. Further studies of these ponds in eastern Ontario should give us valuable information on their utilization for the production of such species as carp and bluegill which have considerable food and even game value. These lakes or ponds may be natural or artificial and when so located that they may be managed in conjunction with general farm activities they constitute so called "farm fish ponds." The aesthetic significance as well as the fish producing capacity of such waters constitute assets worth of development.

There is another type of lake, the small spring-fed lake or pond which, although not deep, is cold throughout the whole summer and which on this basis constitutes excellent speckled trout waters.

By U.S. Conservation Service.

Many wet lands (Class VIII) can be made productive if managed for muskrats, waterfowl or other wild crops. Marsh with muskrat houses.

The streams may be classified on the same basis as the lakes and ponds. We have the permanently flowing spring-fed streams varying in size from extremely small to semi-river, constituting natural speckled trout waters. These graduate insensibly into larger deeper streams or rivers of warmer water which produce such species as pike, pickerel, bass and maskinonge.

Throughout many parts of eastern Ontario, settlement and agriculture have had an adverse effect upon these streams. In general the condition of the streams is becoming progressively worse. Many of the springs are flowing with less volume than formerly or are drying up completely for part of the summer. This was clearly and emphatically demonstrated by Professor Coventry at the recent Conference on River Valley Development and has been emphasized by Professor Leggett in his paper just now presented.

A similar condition is to be found in those streams which formerly flowed from permanent swamps, now drained by straight, deep ditches.

Coupled with this condition of diminution in the summer flow of spring and swamp-fed streams most agricultural lands have drainage ditches for the purposes of removing the water at the fastest possible speed.

The accumulative effect of this is that in the spring these streams and ditches are in great flood for one or two weeks then either dry up or are shrunken and overheated trickles for the remainder of the year. This condition makes them quite useless for the production of any species of fish. The flooding transports silt from the surface erosion of cultivated fields, deforested areas and eroding banks. This silt is changing the stream beds unfavourably and when carried into the lakes is accelerating to an unfavourable degree the rate of sedimentation creating large unproductive shallow areas, covering up rich fish food supplies on the bottom and creating roily water, thus interfering with the transmission of light and so preventing the normal growth of aquatic plants.

Associated with and accelerating the diminution in the value of streams is the pollution by dairy and other industrial wastes being poured into the waters in ever-increasing amounts.

I have emphasized the temperature conditions as a characteristic of waters which control their use for the production of fish. In some cases as for example in larger lakes this condition must be accepted as found and used to the best advantage. In other waters, temperature along with other controlling factors such as sedimentation, pollution, food, the presence of predator and competitor species and spawning requirements are amenable to modification and some measure of control. The food supply may be increased or improved by the introduction of forage or food species, the numbers of predators and competitors may be curtailed and spawning beds or areas may be improved and given sanctuary.

The direct integration of fish culture and general land use is associated most directly with the agricultural and forestry practices on areas at stream sources and adjacent to the streams. These can be of greatest value to the fisheries when they are directed toward maintaining headwater swamps, forest cover above springs, around spring sources and along the courses of streams.

In so far as this tends to re-establish springs and maintains a constant flow it controls excessive spring flooding and summer drought. This is of the greatest importance as erosion and resultant sedimentation of stream and lake bottom brought about by floods, followed by summer drought, result in the complete destruction of all aquatic life including both the fish and their food.

As pollution is also destructive of all aquatic life any land use programme must place emphasis on prevention by control of all industrial and other effluents poured into wild waters.

The development and maintenance of farm fish ponds has a salutary influence in so far as it increases the available food supply by the fish

Cut-over land in Durham County. Marginal land of this type can produce returns from game and fish under proper management.

which it produces and by impoundment creates a water reservoir which contributes to maintaining the general ground water at a high level.

The applied fish cultural activity should rest then on the basis of known or determined best use of each water for the production of the greatest number of the most valuable species of fish which it will support and through integrated land use the general improvement of the water areas for fish production. Each body of water must be considered as an entity complete in itself.

The welfare of the wildlife constituting the game of any region depends upon the presence of ample food as well as cover, giving protection from weather and enemies. Again, as in the case of fish, many of the conditions favouring production of various forms of game are in general quite well known so that the initial work in the development of game is the survey of local areas to determine the extent of favourable terrain and an assessment of the amount and order of the improvement desirable to fit it for the forms of wildlife contemplated.

In the case of game birds it appears that more attention has been given to the introduced species such as the ringneck pheasant and Hungarian partridge than to the native species such as the grouse. These introduced species give promise of constituting a valuable addition to the stock of game birds in some areas although from the very nature of their requirements, particularly with respect to food, their range is definitely limited. There appears to be a much greater chance of unfavourable weather conditions controlling the numbers of these introduced birds than is the case with the native forms, such as the grouse, which on the whole are better able to look after themselves in the face of local adverse conditions. Although there is every incentive to the establishment of valuable introduced species thereby increasing the available stock of game birds, work toward their establishment should not be given undue attention but any management activity can with great advantage be shared with the native ruffed grouse.

It is most desirable that management of the game birds include intensive work on both the introduced and native forms to determine the conditions which limit and favour their distribution and welfare in any particular area.

The integration of land use for the production of these game birds should be directed toward the establishment of such conditions as favour the birds, being at the same time compatible with agriculture, forestry and other land use. This can readily and economically be implemented by the use of waste areas and marginal agricultural land and the application of such woodlot and forestry practices as will supply these species with sanctuary and food.

The game animals, deer, rabbits and hares, present a more difficult management problem. On the basis of their size, freedom to range and food habits, they create a hazard to orchards and field crops making their impact upon normal agricultural activities so pronounced that in some cases at least their numbers require control. Where deer and hare are abundant wolves may increase to the serious detriment of sheep production.

The management of deer is closely related to food supply and is closely integrable with forestry practice which may readily be directed toward the welfare of the deer population.

The game management activity should rest then on the basis of integrated land use directed toward the establishment of conditions which favour the desired forms in the matter of food and cover. Given these favourable conditions any game form that is suitable to an area will maintain itself in adequate numbers even in the face of normal

numbers of predators so that with the exception of some particular local conditions predator control is not a problem of any moment in the game management programme.

Among the fur-bearing animals, those which inhabit the waters along the banks of lakes and streams, including the muskrats and beaver, are or may become perhaps the most valuable for eastern Ontario. Present muskrat populations may be extended and increased by management of lake and stream shore lines compatible with production of these forms and general land use.

The introduction and development of the beaver would be advantageous in some areas as increasing the fur-bearing population and through its dam-building activities favourably influence the water conservation through establishment of multiple beaver ponds. It will be necessary to limit the range of the beaver with respect to agricultural land as they have a great influence on both land and water use in so far as they cut down many trees for use in dam construction and that by their dams they flood adjacent land which may react unfavourably to more desirable land use and fish production.

In any consideration of the integrated utilization of all of the natural renewable resources the commercial fishing industry must receive cognizance. The objective of the fishing industry should be to maintain the populations of such commercial species as whitefish, lake herring, lake trout and pickerel at the highest possible level compatible with complete utilization.

An assessment and analysis of the value of the fish, game and fur-bearing animals to the community constitutes the index of the time and effort that may be assigned economically to the complete development of this resource. The most immediate, direct and probably greatest value of the fish, game and recreational assets of any region is the direct appeal and attraction which it has for tourists, sportsmen and holidayers.

The great value of tourists, campers and cottagers to an area lies in the increased local demand for accommodation in hotels and tourist camps, the employment of guides, the purchase of locally produced food and other produce such as wood work and rugs. The amount of money brought into any region where the people are prepared to take advantage of and develop this trade is markedly appreciable and by increasing the income of the local population influences to a favourable degree the living conditions.

The greatest success in the development of the game and fish resources and the most satisfactory utilization of them may be achieved if the management of these resources and of the tourist and cottage

population is carried out by the people of the region, assisted and advised as necessary and desirable by competent government authority.

Fact finding and analytical surveys have proven of imperative value wherever land use development has been carried out with any degree of success. It is obvious that the fish, game and recreational values will differ greatly in the development of different areas but in nearly every region of any appreciable size where land use development has been carried out it has transpired that they, these fish, game and recreational values, were much more important than originally anticipated as in the Tennessee Valley Authority and the Muskingum River valley of Ohio.

Throughout eastern Ontario it now appears quite evident that large portions of the country would be better suited to recreational purposes and the production of fish and game than to any other purpose and if these resources are to be developed effectively on a sound basis it appears most essential to have personnel well trained in the field of fish and game work taking an active part in the surveys on which the later developments must depend.

I have made the general statement that there is now available considerable general information on the suitability of water and land areas for particular species of fish and game and that we can estimate in a general way some expectation of the crop production from definite bodies of water and tracts of land. It is perhaps safe to say that we have a working knowledge of this field but our present information is far from sufficient for the management necessary to assure maximum crops.

Much additional information on the activities, habits and requirements of the definite species of fish and on the suitability of conditions in different bodies of water is necessary to effect the most satisfactory production of the fisheries resources. This information becomes available as the result of researches such as those now being carried out by the Queen's University Biological Station under the direction of Dr. H. W. Curran and the Ontario Fisheries Research Laboratory under my direction, working in co-operation with the Ontario Department of Game and Fisheries. These research stations have dual functions. In the process of carrying out investigations on the relationships and requirements of the fisheries, men are being trained and so are available for direction of the development of the fisheries resources in adjacent areas. It is most alarming that in Ontario there is no provision for the special study of game or fur-bearing animals or for the training of personnel in this field of work. Many men are now coming to the realization that the lack of information, which is to be obtained only on the basis of research and investigation, and the lack of personnel trained for wildlife work in Ontario is creating a deplorable and tragic situation in relation to the development of the fish and wildlife resources.

If any area is maintaining a good stock of game and fish, the general conditions of that area are in a healthy state and it is a good and pleasant country in which to live. A well-protected reach on the Ganaraska.

These resources, including the fish, game and fur-bearing animals constitute an intricate complex which requires continuous attention and study. It is not sufficient to say that we will establish certain species of fish, game and fur-bearers in definite areas, introduce them there and take no further action. I have already mentioned several conditions which have controlling influences on and are related to the welfare of the fish and wildlife. Any increase in the range or number of fish and animals constituting the wildlife population must be on the basis of modified land use bringing about changes favourable to the fish and wildlife. These environmental changes are going on continuously throughout the year and from year to year and the proper assessment of their relation to the requirements of the wildlife can only be made by a continuous study by personnel trained to carry out that particular work. Moreover, the required attention cannot be achieved by remote control

but must be the definite responsibility of trained personnel working continuously in any area.

The management of fish and game resources is a highly technical profession requiring adequately trained personnel. I should like to emphasize that, irrespective of interest in and enthusiasm for fish, game or any aspect of natural history, the layman is incompetent to carry out game and fish management with any degree of success. Training for this profession requires a biological background with field work in fish and wildlife management under direction.

The continuous development of integrated land use as related to game and fish resources will, over a period of years, result in establishment of permanent populations of fish and wildlife which will, within the limits of annual variations, show a continuous increase.

Management of fish and wildlife resources implies more than the presence of stocks of fish and game, it being definitely related to the continuous utilization of the largest possible crop compatible with maintenance of the population.

In order to maintain maximum production it is necessary to have continuous assessment of the populations of animals present and their relation to the habitat so that, on the one hand, there will be efficient utilization of the environment and on the other sufficient utilization of the population so that the number will be in the order of that which the habitat may be expected to carry efficiently.

This condition of maintaining proper balance between the fish, game and fur-bearing animals and the habitat and assuring the maximum utilization of these resources in an integrated land use programme depends on the co-operation of the resident population with the local permanent representatives of the Ontario Department of Game and Fisheries who are trained in fish and game management.

There is concrete evidence that such a co-operative land use programme can be carried out with a high degree of success as illustrated by the Tennessee Valley Authority and the Muskingum River valley where there is close co-operation among those interests of game and fish, forestry and agriculture, resulting in mutual benefit to all.

Finally the development of any area in the direction of improving conditions for fish and game has an influence on the whole area above even that of increasing the crop of this valuable resource. This rests on the generally recognized fact that if any area is maintaining a good stock of game and fish, the general soil, water and woodlot or forest conditions of that area are in a wholesome and healthy state and that it is a good and pleasant country in which to live. So let us set as our objective, the establishment of the game and fish resoures at a level compatible with the best land use and we shall inadvertently profit our Province greatly.

4

THE NEED FOR URBAN AND RURAL CO-OPERATION IN RIVER VALLEY DEVELOPMENT

W. H. Porter

Secretary, Ontario Conservation & Reforestation Association and Editor of the Farmer's Advocate and Home Magazine, London.

URBAN people have co-operated wholeheartedly with country folk in the exploitation and denudation of the countryside. It is only fair that both should co-operate in the restoration.

Every nation, it seems, enjoys, in its youth, a period of wild exploitation and wastefulness. But when the wild oats are sown or should all be sown, then a decision is reached and the nation takes one of two roads. One road leads to constantly lessening production and ultimate abandonment; the other to a continued use of conserved natural resources.

North Africa, once the granary of the great Roman Empire, took the wrong road and eventually became a desert. The Eastern Mediterranean countries took the wrong road and many of the once glamourous cities in that region have been completely and permanently buried by the produce of erosion. China continued on the wrong road for so long that millions of Chinese now die annually as a result of famine or floods.

Central Europe saw the handwriting on the wall and interpreted it correctly. France and Germany, both old and thickly settled nations, have a larger percentage of wooded area than does Old Ontario. Britain has more than twice as much. Scandinavia, still densely wooded, has the best forest conservation policy in the world.

In Nora Wahn's book, "Reaching for the Stars" there is a chapter telling how the German people were zealously cutting down their forest in order to grow more food; but they found eventually that as they destroyed more forest and brought more acres under the plough food production decreased. They diagnosed the situation correctly and there developed in Germany, as in France, a state policy of retaining 18 to 20 per cent. of the land under forest cover.

It is only in the last twenty years that the United States has ceased to sow its wild oats and there is now in force across the line a huge conservation programme involving the expenditure of millions of dollars. Canada awakened only in the last five years and while exploita-

tion and waste have not been checked there is a rapidly developing public opinion that will demand state leadership, appropriate government policy and a programme of conservation.

We have sown our wild oats in the characteristic care-free manner and there are signs that Canadians are ready to settle down to a policy of restoration and conservation.

Before suggesting that urban and rural people join hands in the new programme of community development it might be well to establish the fact that rural-urban co-operation is already functioning in regard to suburban roads, secondary education, law enforcement and care of the needy.

These are on a contract basis, both parties entering into an agreement to bear their rightful share of the costs and to contribute those services for which they are best equipped.

I have mentioned the contractual relations between town and country but more significant, in my mind, is the purely voluntary co-operation sponsored by Chambers of Commerce, Boards of Trade, Service Clubs and lodges. These groups of urban citizens have gone out into the country, they have organized and aided youth clubs of all kinds and during the last 25 years they have done a wonderful job and have created a splendid bonne entente between rural and urban people.

The foundation for this new movement of co-operation in River Valley Development and in the restoration of the countryside is already well and truly laid.

Some urban people may ask "why should we concern ourselves with rural problems. We have enough of our own? Let the country people do their job and we'll do ours!"

That philosophy is basically sound, but peculiar as it may seem to the majority of urban citizens, the unwise use of land and the denudation of the countryside is an urban problem of major importance. With the economic and social consequences of denudation and excessive drainage I shall not attempt to deal. Those phases of the problem are repeatedly discussed in newspapers and magazines. The importance of ample water supplies is likewise emphasized but this one factor alone is so vital that urban people could very well take the lead in re-creating those conditions that will insure enough water for domestic and industrial uses and enough water to carry away the effluent from urban sewage disposal plants.

When streams and rivers become open sewers in the summer and devastating torrents in the spring, urban dwellers cannot longer ignore the dangers nor can they depend upon groups of citizens living 25 or 50 miles away, to expend labour and capital in making conditions safe and pleasant for other groups living farther down the river valley, most of whom they do not know, have never seen and never expect to

see. I cannot refrain from saying a further word about urban water supplies secured from underground sources. Some engineers, apparently, work on the theory that the Great Architect of the Universe hid supplies of water beneath the earth's surface and it is their job as engineers to locate the hidden treasure. It has developed into a game of hide-and-go-seek with the Creator with little recognition given to the fact that underground water resources (when not replenished from large inland bodies of water) are influenced to a large extent by the character and treatment of the countryside above. This is an accepted doctrine in Northeastern United States where scores of urban municipalities have protected their water sheds with forest cover. I have visited some of these in company with E. J. Zavitz and F. S. Newman, and while the engineers and superintendents admit dozens of mistakes, some of which are readily apparent, all the officials were one hundred per cent. unanimous in the conviction that their water supplies were increased and the quality improved by suitable forest cover on their watersheds.

One of the tidiest properties of this kind I have ever seen was at Gloversville in New York State. Before going up onto the watershed we were thoroughly briefed and told what we might and might not do. The Superintendent obviously thought of that watershed in terms of health, just as a tidy housewife does of her breakfast table.

This fact has some significance: In the neighbouring Republic there are 1,500 community forests scattered throughout 30 states. Altogether they cover 3,000,000 acres of land. These are not all planted by urban municipalities for the protection of water supplies but all represent community action and the type of urban-rural co-operation that I am recommending to this Conference to-day.

This is what I suggest:

(1) Community forests planted and developed by urban municipalities for the protection of their watersheds, to create recreational opportunities, to provide employment for their citizens and to furnish fuel and timber on a short haul basis.

(2) Community forests developed by urban municipalities as training and recreational centres for Boy Scouts, Rangers and other youth organizations

(3) A rapid development of the planting programme upon which counties and townships have already embarked. In this connection I recommend that state and rural municipalities locate their plantations strategically so the benefits of forest cover will accrue to all citizens, urban as well as rural.

(4) That all colleges and universities in Ontario maintain a forest of 500 or 1,000 acres as standard equipment. If properly used

it would soon become the most important laboratory in any university plant.

(5) That the Province proclaim a "Conservation Day" or "Community Forest Day" at some appropriate date in the spring when urban and rural people would unite in forest planting, stream improvements, roadside planting and in the improvement of ugly and waste places.

In case some people, even in this Conference, might dispatch these recommendations as "fuzzy idealism" I propose to mention a few instances of effective urban-rural co-operation that have already developed spontaneously.

(1) The Boy Scouts of this Province have planted 1¼ million trees in Simcoe County and about 200,000 in Norfolk County. From an 82 acre plantation in Simcoe County a revenue of $2,250.00 was secured last fall through the sale of Christmas trees.

(2) Senior pupils from the rural schools in North Dumfries planted a considerable block in the Waterloo County forest last spring and demonstrated what could be accomplished by senior public school pupils and secondary school pupils if they were permitted to enjoy this privilege annually. The school forests of Simcoe County, instituted by George Barr, are another demonstration of the possibilities. There is yet no record of school pupils being injured or exploited in this enterprise. I can see no reason why it would be harmful to urban pupils, and I know they would be delighted to spend half-days at just such a job in the country. It would do them good and they would learn more than when imprisoned in city school rooms.

(3) The Fish and Game Association of Woodstock and Ingersoll, with the assistance of the Boy Scouts, planted 15 acres in the Oxford County Forest during one afternoon last spring and 5 more acres during an evening's work. Wilfred Ratz, President of the Association, expressed the opinion that when properly organized and with the assistance of the Boy Scouts they could plant 100 acres in four afternoons. The Fish and Game men aren't fooling. They want fish in the streams.

(4) Furthermore, it is not fantastic to suggest urban forest plantations, even in Ontario. The following urban municipalities have already established small plantations in neighbouring townships:
Midland, Mountain, Richmond Hill, St. Marys, St. Thomas, Trenton, Unionville, Warkworth, Woodstock, Woodbridge,

Markham, Tottenham, Port McNichol, Penetang, Beeton, Brighton, Bobcaygeon, Brampton, Coldwater, Colborne, Erin, Grand Valley, Hanover, Owen Sound, Hillsdale and Orangeville.

These plantations vary in size from 2 acres to 100 acres. The average for the 27 mentioned is 16 acres. Seven of them planted on their watersheds and the most notable results have been achieved by the Village of Beeton.

Rather than attempt a complete thesis on urban-rural co-operation in river valley development I have limited my discussion to only one phase of the problem where co-operation might really commence. Papers and discussion during this Conference will reveal other possibilities and other needs.

I am not unmindful of the fact that proper and adequate development of any river valley in Ontario can only be accomplished under appropriate legislation that bestows the necessary power upon properly organized bodies and provides for an equitable distribution of the costs. In this joint effort we leave the field of voluntary co-operation and come back to contractual relations mentioned earlier in this paper. Urban and rural municipalities have learned how to co-operate in regard to suburban roads, secondary education, law enforcement and in the care of the needy.

They would simply apply the same technique, on a much larger scale, in the development of an entire river valley. This would be done for the protection of life and property and for the benefit of all the people, rural and urban alike.

That should be our objective. In the body of my paper I have attempted to suggest something for the present—some urban-rural co-operative action to take the place of anxious inertia.

DISCUSSION

QUESTION: I wonder if Mr. Porter would outline briefly the school plantation competition which is being held in Ontario this year?

MR. W. H. PORTER: Thank you for the opportunity to put in a plug. There has been an effort made by counties and townships in the past to introduce the idea of a school plantation. Norfolk did it under one method which worked very well, and Simcoe County has "township forests" where all the pupils of the township come to one central place and plant a forest of their own—a township school forest.

Well, a year ago the Ontario Horticultural Societies in their Annual Convention in Toronto set up a Committee on Conservation, the Chairman of which is Mr. J. E. Carter of Guelph. Mrs. Boucher of this city is another member of the Committee. Fortunately this man Carter is an active man and is trying to get something started. He has proposed a competition and I would like to say that Mr. Carter has put up $100 as a grand prize for the best School Forest of the Province, and $125—also his own money—as a prize for each of five zones in the Province. A suggestion was made that the Ontario Conservation and Reforestation Association also contribute and the Chairmen of the different zones have agreed that they should do so, to the extent of $25 in each zone, making $125.

5

THE ROLE OF LIVING THINGS IN THE CARE AND USE OF LAND

By Dr. Edward H. Graham
Chief, Biology Division, Soil Conservation Service, U.S. Department of Agriculture

IT IS my purpose this evening to tell you something of how soil conservation work is done in the United States. What farmers and ranchers have accomplished during the past 10 years in the States is truly remarkable, and bears careful scrutiny. The brunt of my presentation will be borne by the coloured slides I am to show you, which tell much of the story themselves, but a few points can well be made first. The soil conservation movement, as it is presently developing, is one of tremendous significance, not only as it affects the care and use of land, but with respect to better economic yields from the soil and as an influence for social improvement in American agricultural life.

As you may know, we discovered as the result of a national survey in 1934 that in the United States there were some 282,000,000 acres of land ruined or severely impoverished by accelerated or man-made erosion—an area equal to the combined acreage of Texas and California, our two largest states, or an area larger than the whole of the Province of Ontario. In addition, another acreage three times as large—approximately 775,000,000 acres—was damaged to some extent by soil washing. Thus about half our total land acreage—including crop land, range land and pasture land—was adversely affected in some degree by soil erosion, a large portion of it seriously. The cost of erosion in the States has been estimated at nearly four billion dollars a year. The figures themselves, though staggering, are a poor expression of the irreparable injury to our first and our most precious natural resource, the harm to our national welfare, and the disaster to the people who live upon such land.

To-day we are still far from recovery of the malady we began to diagnose in 1934. Although a quarter of a million of our farmers are now working in a programme to control erosion, not more than a tenth of our job has yet been touched. But with more than ten years' experience behind us, there is every indication that we are gaining strength. The future is hopeful. Our rate of conservation progress to-day is a great deal faster than it was before the war. And the rate is improving steadily all the time.

I should like to call your attention to a few significant elements in our attempts to solve this very important problem of soil erosion. I

should like to point briefly to: (1) The demonstration method; (2) the co-ordinated approach; (3) the land capability classification; (4) the individual farm plan, and (5) organized local action. Each of these five elements, we believe, are indispensable to the successful completion of a soil conservation and land use programme.

DEMONSTRATION METHOD

Let us look first at the *demonstration method.* In countries like ours, where individual initiative has developed to a high degree, people do not accept a change in their manner of living because someone thinks it is good for them, or, much less, good for the country. They demand proof. Therefore it was necessary to establish, first of all, appropriate national leadership in this field. The first step was taken when the Congress of the United States appropriated funds for conducting investigations in soil erosion. Beginning in 1930, several soil erosion experiment stations were established. Three years later an emergency agency of the Federal government was set up to help farmers protect their soil, and in 1935, just short of ten years ago, this agency became a permanent bureau in the United States Department of Agriculture, and was named the Soil Conservation Service.

It was early recognized by the dynamic leader of this new organization, Hugh Hammond Bennett, that learning about erosion and talking about it would not stop the soil wastage so widespread across the land. People must not only learn to recognize erosion; they must take action on the land, themselves, if erosion is to be halted. What better place to do this than on their own farms? Consequently, numerous areas were selected throughout the country where erosion was serious, and demonstration projects of approximately 25,000 acres each were set up. Farmers were invited to work with professional soil conservationists in applying to the land various methods and specific practices designated to control erosion. By actual experience and observation, therefore, co-operating farmers and their neighbours in these demonstration areas learned the practices that worked.

By the end of 1937 there were 504 soil conservation demonstration areas, covering nearly 12 million acres in different parts of the country—north, south, east, and west. These demonstration projects served as large-scale proving grounds, created widespread interest, and protected a lot of land. They also gave rise to soil conservation districts, to which I shall refer again in a moment. Along with and resulting from the work in these early demonstration projects, there developed some fumdamental tools or techniques. The first of these is what we call the *co-ordinated approach.*

By U.S. Soil Conservatson Servic

Protecting stream banks from under-cutting by willow poles laid on bank previously sloped and held down by posts and wire. Note sprouts on poles. Some willow cuttings and conifers were also planted. Taken in May, 1936.

CO-ORDINATED APPROACH

It was soon learned that a complex problem like erosion control—a problem essentially ecological in nature with the added factor of use involved—could not be solved by the application of a single science. Engineering alone could not do it, neither could agronomy, nor any other one science. Recognizing this fact, there were established in the Soil Conservation Service separate Divisions of Engineering, Agronomy, Forestry, Biology, Conservation Surveys and, for the western states, Range Management. Economists, social scientists, geologists, and others were also employed. The objective was to focus upon the one problem of soil erosion every technical discipline which was in a position to contribute to its solution. As early as *1934*, Dr. Bennett wrote that erosion must be attacked through "the application of accumulated knowledge pertaining to the great multiplicity of variables affecting the three-phase process of absorption, run-off and erosion, employed not as single unco-ordinated implements of attack, but collectively, according to the needs and adaptability of the land, in a combination of integrated control measures, to be supplemented where necessary by new information

accruing from the experience of combat." We have not lost sight of that objective; it has proven valuable and essential to the point of being mandatory for success. At first, it was not easy to co-ordinate the contributions of these diverse fields. After all, not only was the science of soil conservation very young, but the idea was new that various technicians could work co-ordinately to do a common job. No other agency has tried such an approach. Engineers had to learn to work side by side on the land with biologists, and understand their viewpoints and contributions. Foresters had to do the same with agronomists, range managers with conservation surveyors, and all of them with each other. It took time, but the amalgamation of all pertinent techniques is prerequisite to a full fledged attack upon the important problem of soil conservation and sound land use. Gradually, in the Soil Conservation Service, these specialists in engineering, agronomy, forestry, and so on, became specialists in a broader field; soil conservation. They became soil conservationists.

This was a development of extreme importance, for rarely is a land problem or an associated water problem encountered on any farm or ranch that can be solved through one of the single, specialized sciences. The Soil Conservation Service and the soil conservation programme in the United States is reversing a trend that developed over a period of

The same bank in August, 1938.

By U.S. Soil Conservation Service.

By U.S. Soil Conservation Service.

Improved pasture on ten percent slope. Excellent land use and erosion control.

more than a century. Instead of going further in the direction of narrow, intense specialization, we undertook, in a sense, to generalize—or more exactly, to synthesize. We combined and co-ordinated a variety of pertinent, highly specialized sciences into the compound science of soil conservation. We learned early in our work that this was the only practical and the only efficient approach to the soil and water problems presented by entire watersheds, entire farms, and entire ranches. One of the corollaries of the co-ordinated approach is that every acre of an operating unit of land—farm, ranch, or other—should be used for the purpose for which it is best adapted. This idea is given concrete expression in the *classification of land according to capabilities.*

LAND CAPABILITY CLASSIFICATION

It is perfectly reasonable to assume that before a permanent plan for erosion control or land use can be developed for a unit of land, an analysis appraisal of the land must be available. Land planning and land classification go hand in hand. *Land capability classification* assumes a purpose for every parcel of land, and serves as a basis for determining its most intensive sustained use consistent with preservation of the land as a permanently productive resource. It furnishes the farmer with a guide for the soil conservation practices he will apply. The ultimate aim,

of course, is to sustain at a high standard of living, not only the families which now live on the land, but those who in the future will occupy it.

We do not maintain that our land classification is the final one, but it is working well. As I shall soon point out with the aid of the slides, there are eight classes, based on kind of soil, degree of erosion, slope, and other factors. The first four classes are suitable for cultivation, with varying degrees of use. Classes V to VII, inclusive, are not suitable for cultivation, but can be used for pasture or woodland. Class VIII is not suitable for any of these uses, i.e., yields of cultivated crops, livestock, or forest products, but it is suitable for production of wild plant and animal crops. This is often called "wildlife land", and its potential use strikes a new note in land classification. It includes some land of importance primarily for its scenic and recreational value, and some highly useful for wild crops. Illustrations of Class VIII land are coastal and inland marshes, lakes and swamps, odd rough and infertile spots, badlands, mountain tops and dune areas.

In the classification of land according to capabilities there is, in short, no parcel of land, large or small, for which a use is not designated, and the concept of idle land is gone. In all of this, of course, there is no thought that every land class *must* be used as intensively as it can be,

Red oak type woodlot—to the left of fence has been grazed—on the right is not grazed. Note disappearance of reproduction under grazing, also introduction of grass and opening canopy.

By U.S. Soil Conservation Service

for many parts of Canada, no doubt, will long remain principally recreational areas, although they could conceivably be used more intensively without permanent injury to the soil resources.

THE INDIVIDUAL FARM PLAN

The greatest use of the land capability classification is made in preparing *individual farm plans.* The classes of land are outlined on aerial photographs of a scale of four inches to the mile, and the portion pertaining to an individual operating unit of land is reproduced for that unit. Upon the aerial photograph showing present use of the land there is superimposed in colour the outlines defining the classes of land occurring on that farm. Based upon the land classes indicated, land conversions or adjustments in use are made where possible. Where major changes from cropland to woodland or woodland to pasture are required, years may be necessary to see the entire use of the land brought into complete agreement with its physical capabilities. But the map affords the farmer a permanent guide and helps him to understand the objectives involved.

Along with the map is a written statement outlining those things the farmer agrees to do, not only in land conversions, but also in the establishment of soil and water conservation practices for each land class. On land already in cultivation and permanently adapted to such use, strip cropping, terracing, terrace outlets, crop rotations and other practices may be necessary if the soil is to be used most wisely. On pasture land, furrowing, seeding, fertilizing and rotation grazing may be called for. In the woodlot, thinning, planting of a shrub border, and other measures may be agreed upon, and in the big gully a pond may compose the best land use. From a marshy spot too wet to graze or grow trees, muskrats may be the most appropriate crop, and on the eroding field margin or galled spot a growth of native shrubs may yield useful wild fruits or game birds. In such manner does the farm plan outline the best potential use of each parcel of land, and the conservation practices most appropriate to them. Without such a guide for each farm, ranch, or other operating unit of land, it would not be reasonable to expect to develop a long-term programme of soil and water conservation.

SOIL CONSERVATION DISTRICTS

To-day in the United States, such plans, based upon the land capability classification and embracing the technical recommendations of soil conservationists—combining the techniques of agronomy, engineering, forestry, biology, and range management—are guiding the land use work of some 260,000 farmers and ranchers. All of this is being done, furthermore, in a methodical and organized manner. As a result of experience

in the early demonstration projects, farmers soon decided they wanted more soil conservation, and that this could be better achieved by working together than by working independently. There developed a demand for a permanent, new type of farmer organization on a community basis, with legal status, to insure progress in soil convervation.

As a result there sprung up the *soil conservation district*, a political subdivision of a state, directed by five local farmers, three of whom are elected by members of the district, the other two appointed by the State Soil Conservation Committee. The first district was established in the fall of 1937. To-day there are more than 1,200 districts in 45 states, embracing about 668 million acres of land—more than half the agricultural acreage of the country. Each district develops, with the assistance of various federal and state agencies, a general programme and plan for the work of the district—a plan which includes many different practices designed to prevent erosion on cultivated land. It also embraces appropriate pasture, range, and woodland management plans which make the best use of these resources without damage to the soil, and it includes suitable fish and wildlife management measures. Each resident of the district intending to apply a programme of soil and water conservation may then enter into agreement with the district, in accordance with land use objectives for his farm as set down in the farm plan. Note that the farmer does not co-operate with the federal government or with the state, but with the soil conservation district of which he is a voting member.

At the invitation of the district, the Soil Conservation Service provides technical assistance to the district by preparing the land capability and other maps, by furnishing "on-site" assistance in order to help the farmer effectuate the plan, and, in some instances, by providing nursery planting stock and the loan or grant of heavy equipment. It is hoped that the districts eventually will require only technical services from the government. And already, in some parts of the country, independent soil conservationists are selling their services to districts in laying out terraces, building ponds, et cetera. Private contractors are also being employed by districts to do big jobs that cannot be done by ordinary farm equipment.

Thus, there has developed in the United States within the past ten years a new and powerful force for better agriculture—the soil conservation district. It had its genesis in the governmentally-sponsored soil conservation demonstration projects in which farmers tried soil conservation methods. By use of the individual farm plan, based upon a careful analysis of land capabilities and embodying suggestions of various technicians, farmers in these projects not only refined conservation practices, but developed a successful method of unifying their efforts in

By U.S. Soil Conservation Service.

Eroded stream bed with spreading gullies. The headers and off-shoots were stopped by water impounded by a dam below.

applying them. Thus, there finally emerged, with full status under state law, a local community organization capable of operating in a democratic way to solve a problem of great concern to both the individual and the Nation. It provides the farmer with a "Bill of Rights" with respect to his future security on the land which he owns and manages. It provides for him the opportunity to maintain his land in a permanently productive condition as the basis for successful living upon the land.

SOIL CONSERVATION PRACTICES ILLUSTRATED

At this point I should like to direct your attention to a series of coloured lantern slides which will illustrate better than anything I may say what farmers and ranchers in the United States are doing to conserve soil and water on the lands they own and operate. Here you see pictures of contour cultivation, strip cropping, terraces and diversion ditches, grass waterways, vegetated terrace outlets, well-managed pasture and protected woodlots, green manuring and soil-saving crop rotations, gully plantings, hedges and field borders, streambank revegetation, ponds for fish and livestock water, and many other practices useful in soil and water conservation and proper land use. (One hundred coloured slides of conservation practices were thrown on the screen, with running comment by the author).

Permit me to dwell particularly upon the use of parcels of land often believed to be of little value, for one of our wartime jobs is to bring speedily into production as many as possible of our so-called "wasted" acres. Some such lands, unsuited to intensive farming, already are contributing food and other products needed in the present emergency. Enough has been done to show how worth-while it is to develop every hidden asset of every acre.

Some parcels of land are most economically used when specifically managed for wild crops. Other lands, primarily dedicated to tilled crops, pasture, or woodland can, with slight modification, provide useful wild plants and animals. What are some of the practices applicable to wasted acres which help to support a country at war and assist us to make maximum use of our land resources without waste of time, labour, materials, and funds?

FISH FROM THE FARM POND

Fish from farm ponds have been contributing materially to the Nation's food production programme; with the application of known simple management practices they can produce a great deal more. The farm pond provides water for livestock, a refuge for waterfowl, a home for fur-producing muskrats. It is also as productive of protein and vitamin-rich food, acre for acre, as highly developed livestock pasture. We cannot afford to neglect the potential source of many million pounds

The same gulley two years later. The earth fill has backed water up to the heads of the gullies forming a useful and attractive farm pond.

By U.S. Soil Conservation Service.

of palatable food per year. With "red" meat rationed, every pound of pond fish is a pound of meat to the good. This is all the more important now that our supply of marine food fish has been reduced through conditions necessitated by the war.

The raising of pond fish is an old and much-used type of farming in many parts of the world but until recently it received little attention in the United States. Modern methods of pond fish production are based upon the maintenance of a rather easily managed food chain. Ordinary fertilizers are added to the water of the pond to provide nutrient elements. These support microscopic plants that serve as food for minute animals. Water insects feed upon these animals and the microscopic plants. In turn, the insects and small animals—protozoans, rotifers, crustaceans—provide food for forage fish such as bluegill bream. The forage fish are eaten by carnivorous species, for example, the large-mouth black bass. Both the bream and bass furnish food for man. The practical marvel of this scheme is that fingerlings stocked last spring will produce bream weighing a quarter-pound and bass weighing a pound apiece next summer. Even a war economy can expect no better production than this. Furthermore, ponds, properly fertilized and managed, will yield per year 200 to 400 pounds of edible fish per surface acre of pond at a cost of from three to ten cents a pound.

How fortunate are Americans to have at their disposal tens of thousands of farm and ranch ponds already constructed and awaiting only slight attention to produce nutritious and tasty food! The London radio tells of housewives standing in line to buy fresh fish for making "fish and chips"; their supply has been severely reduced because English fishing trawlers have been needed as mine sweepers. In the United States we eat a great deal of fish—more than a billion pounds a year, if we consider fresh, frozen, cured and canned kinds. Much of this is marine fish. It would, however, be practicable to add enough farm and ranch ponds and reservoirs to furnish us with 100,000,000 pounds or more of fresh fish every year. Even our present production will be greatly valued locally, especially in the South where management is most highly developed and the pond fish are most prized for food.

WILD FRUITS

All too frequently it is forgotten that wild shrubs which will grow in special sites not able to support cultivated crops can furnish both food and profit. In the acid bogs of the northern States, cranberries and blueberries offer a source of considerable revenue. Improved varieties of the latter are now available and in some years they provide a return up to $750,000. Yet this is a pittance compared with the return from the wild

crop. In a good year, huckleberries and blueberries, picked from wild, unimproved stock, provide in the United States the astonishing return of $10,000,000. The wild low-bush blueberry of Maine and the Lake States alone provides a return of nearly $5,000,000. Other kinds are highly valued in the east, south, and west. The florists pay to the States of the Pacific Northwest as much as $200,000 annually for the branches of thick, shiny, dark green leaves of the Pacific Coast evergreen blueberry useful for decorative floral effects. The same blueberry provides an annual food crop valued as highly as the branches.

As a part of the programme to control erosion on agricultural land, biologists have recommended the planting of grasses, legumes, and shrubs on gullies, odd spots, field borders, and other eroding areas. Planted as parts of complete farm lay-outs directed at better use of each acre on the farm, shrubs for these small eroded areas—useless for tilled crops, pasture, or woodland—have been selected not only for their erosion control usefulness, but for the wildlife food and cover they provide, and the human food they produce. The wise wife of the farmer will not neglect the patch of wild plums, cherries, currants, high-bush cranberries, elderberries, grapes, and other wild fruits growing now on that "worthless" spot down by the creek, for they are the source of delicious preserves, jellies, jams, pies and sauces. Unlike cultivated shrubs, these wild ones require no pampering, for they are adapted to soil conditions unsuited to more refined use and, once established, will fend for themselves.

Our wartime supply of many fruits is reduced because a substantial share of our production goes to the armed forces, labour is scarce, and metal and rubber for domestic canning, other than for home use, are restricted. It thus becomes apparent that we can expect an appreciable contribution to our supply of fresh fruits from those wild kinds most easily grown for use on the individual farm. Furthermore, the labour required to make use of wild fruits available "at home" is far less than that needed to pick, pack, and distribute most cultivated kinds.

Wild plum, a thicket-producing, erosion-control shrub of great value for wildlife cover, is highly prized for human food. Erosion control operations recently have called each season for 500,000 plum seedlings of three species, and many farmers also seed wild plums directly, a practice which lowers the cost of establishing the plants. Wild cherries are much planted and the western sand cherry is a favourite, for it not only holds soil in sandblow areas, but produces a large well-flavoured fruit. Many other berries, grapes, hazelnuts and filberts, are numbered among the food producing shrubs planted to hold soil and prevent excess run-off on our farms and ranches.

Soil Conservation Service nurseries have produced 150 million shrub seedlings for establishment on a quarter of a million American farms and ranches as part of erosion-control operations. Others have been seeded directly, and many of them bore useful fruit last fall. Species of value for human food comprise 30 per cent of all the seedlings used.

An indirect use of many shrubs planted on wasted areas is the contribution they make to honey production by providing bees with both nectar and pollen. You may not realize that honeybees, the only source of honey and beeswax, produce each year in the United States more than 200 million pounds of honey and four million pounds of beeswax. In spite of this large production, we import an additional four million pounds of beeswax annually. Beeswax not only has many peacetime uses, but is irreplacable in time of war for making ammunition grease, models, machine patterns, pharmaceuticals, leather dressings, finishes, and polishes.

Honey is all the more sweet when sugar is scarce. Perhaps the most important contribution of bees, however, is their assistance with seed production through pollination of pasture legumes and other plants useful in conserving soil, and the fertilization of fruit tree flowers. Throughout the country many plants used in our food production and

Gullies may be checked by planting with trees, shrubs or cover plants. A gully system in Illinois, planted chiefly with black locust.

By U.S. Soil Conservation Service

By U.S. Soil Conservation Service.

The same gully three and a half years later.

better land use programme are valuable bee plants. An example is the shrubby bicolour lespedeza which recently has come into extensive use in the South as the woody element in the field border planting established on eroding margins between crop fields and woodlands. This lespedeza is much used by bees—good honey plants are not abundant in the South—and it furnishes a very light-coloured, mild honey. Sweet-clover, which grows very well and is extensively used on depleted soils to check erosion, is rated as a top-notch bee plant. In Canada, as you move forward with your soil conservation work, you will want to search out special plants, adapted to your soils and climatic conditions, which will serve both to control erosion and provide useful production from the land, whether the land be devoted to tilled crops, pasture, woodland, or yields of wild plant and animal products.

FARM FURS

The environs of the farm pond, the marsh or swamp, stream bank or wood lot, all offer opportunities for the production of farm fur bearers. Since the war, the quantity of furs used by civilian Americans, usually to the tune of about $120,000,000 worth each year, has been reduced fully 50 percent, for imports have practically ceased. Furs are not entirely a luxury item, in spite of their great use for high-priced evening

wraps; fur coats, caps, and mittens are practical and useful articles of clothing in many parts of your country and mine. Furthermore, furs are used for many special garments, for the making of felt, for brushes, ornaments and other items. The making of fur vests for the Merchant Marine to-day stresses the value of fur for warm, protective clothing, and our men in Alaska, Greenland, and Iceland, find fur clothing warm and comfortable.

Although we have on hand an adequate stock of both imported and domestic furs, this supply is not inexhaustible, and tests being made by the army indicate greater possible use of furs by our fighting forces in cold regions and high altitudes. The farm is a place where some of these needed furs can accrue as a by-product of ordinary operations. Muskrat, opossum, skunk, raccoon and mink live well on farm land, and even our most intensively cultivated areas can produce a good crop of fur. For example, Iowa, where farm land makes up 95.3 percent of the state's acreage, produces an annual average of 272,000 muskrat pelts, 105,000 skunk skins, and 75,000 opossum, mink, and raccoon hides. This take is valued at $625,000 per year, and three-fourths of it is produced on less than five percent of Iowa's agricultural acreage.

To the farm family there is profit in the managed fur harvest. Although the farmer is busy with the production of staple foods, the farm boy will find time to run a trap line, and many farmers' sons who have made the bulk of their college money that way will attest its benefit. Fur bearers can contribute more than their pelts to the war effort, if they are used without waste. Hunters are being urged now to save the bodies of all small mammals killed, so that they may be rendered for glycerine to be used in making explosives. Moreover, fur bearers can provide food. The opossum has long been a favourite food, and in Louisiana, muskrat carcasses are being frozen in local storage plants, dressed as "muskrat hares" for table use in eastern markets. The flesh is dark coloured and well flavoured, and the only special treatment required to make the animals entirely fit for food is the removal of the two musk glands. In Louisiana alone, 6,000,000 muskrats are caught annually, providing a potential meat supply, equivalent to 6,000 beeves.

SELECTIVE SERVICE FOR EVERY ACRE

In time of war it is more than ever necessary to prevent waste. This is true of time, steel, oil, rubber, manpower, food, fibre, transportation and, no less than all the rest, the land. The land is used wisely when it is made most productive without loss of the fundamental resource —the soil. Waste of land can be prevented by using seed, fertilizer, horsepower, and time, only on those areas that we know will produce high

yields. It is an inexcusable waste to seed, cultivate and fertilize badly eroded soils and galled spots, highly alkaline areas, or depleted field borders that are inherently unproductive, and to plow into the creek bank where the field will tumble into the stream with the next freshet. It is also unwise to expect most profitable returns from cattle pastured on rocky outcrops, escarpments, sand dunes, in wet marshes or woodland. To try these things is to build a house upon quicksand—and as unreasonable and profitless. Yet there are for these areas profitable uses requiring little time, effort and cost; uses that will render them productive with as great a return on investment as can be realized on any acre of the farm.

These small areas, scattered over our farms and ranches—a quarter acre here, two acres there, or an occasional vast stretch of marsh, together with the borders of streams and ditch banks—add up to the surprising total of more than 33,000,000 acreas of land throughout the United States, an area nearly equal to that of all New England. In Canada you must have tremendous acreages of land of this sort. These lands erode, often more than others do, but they can be made to produce crops—crops of useful wild plant and animal life—the crops which comprise the "Selective Service" for these lands.

It is with this objective in mind that the biologist makes one of his real contributions to the management of agricultural lands. He aids in preventing attempts to produce high yielding crops on unproductive sites, determines for such areas adapted crops of useful wild plants and animals, and develops management recommendations for producing them. Thus the marsh too wet for pasture yields muskrats and other fur bearers, the eroding area gives forth fruits for human as well as wildlife use, and the pond supports an abundance of food fish.

Just as it takes more than one skill to make a plane or plan a campaign, so it takes more than one technique to manage land. The farmer, economist, agronomist, engineer, forester, range manager, biologist—all are needed to coax from the yielding land the food and fibre needed to fight this War and win the Peace. Together they can classify each parcel of the land for the use to which it is most nearly adapted, and accordingly manage it for the highest production at the lowest cost in labour, money, and materials. All of this is not alone for to-day's extreme effort, but that the land be preserved as productive next year, next decade, next century, as it is to-day, so that we may prosper and our Nations endure.

6

"FOREST REGIONS OF SOUTHERN ONTARIO"

G. M. Dallyn
Executive-Secretary, Canadian Geographic Society, Ottawa

INTRODUCTION

AS its title suggests, my paper is fairly broad in scope. It deals briefly with the history of a century and more of Canadian stewardship. We are only too familiar with its failures and deficiencies; it has been the old story of a land of plenty depleted by wasteful exploitation of natural resources and a complete absence of any noticeable long-term planning or conservation measures—up to a quarter of a century ago.

Conservation measures in the forest region south of the French and Ottawa Rivers in Ontario were initiated in 1912 when, under the old Commission of Conservation, a survey of the Trent Watershed was made, following which a forester was appointed for Ontario. From this developed our present technically directed Department of Lands and Forests, now operating with encouraging efficiency after various ebbs and flows—the tides, at times, being seriously affected by old and influential lumber interests, incompatible with growing public recognition of a need for a progressive long-term conservation programme.

The condition of these forest regions records indelibly the story of our stewardship. At one time the scene of a vast pine commerce, they now possess few stationary mills of any size; in the Trent region, for example, we find mainly portable saw-mills cutting hardwoods. This condition was brought about, previous to the introduction of conservation measures, by the repeated forest fires which swept the logged-over and adjoining areas following cutting operations. Fires, twenty-five years ago, were considered inevitable. To-day, following the introduction of modern techniques in the combatting and prevention of forest fires, we know better. The tide of destruction of our forests has been encouragingly stemmed. It is improving year by year. If, however, we are to plan for general proper land-use of this area, we must replace weak links and forge new chains that will ensure, so far as humanly possible, a fire-proof region—one that will not only safeguard the present stands of timber, the protective forests, the home of wild life, the summer retreats and homes and livelihood of human inhabitants, but also the second and young growth and any plantations which may be established. That this will be no experiment is proved by the experience of the past twenty-

two years since district organization was inaugurated under the supervision of foresters.

Before presenting in greater detail the conditions which must be dealt with, may I briefly outline a plan of rehabilitation which has at least the merit of some years of thought given to the subject. This plan would not only, in time, be financially self-liquidating, but would add increasing revenues to the provincial coffers, would provide immediate rehabilitative employment to many thousands of returned soldiers, would stabilize the population in rural centres, and provide, as well, an emergency employment area close to our urban centres for periods of hard times and unemployment such as we experienced following 1929.

Rehabilitation of Farm Woodlots

The farm woodlots of old Ontario have for years furnished by far the greater portion of the wood cut for fuel in Ontario. This has brought about a progressive depletion in area and a progressive deterioration in the quality of the woodlots still remaining. In fact, half of the fully-settled counties already have less than ten per cent of their occupied farm area under woodlots. A careful survey of this region made some years ago under the direction of the Dominion Fuel Board resulted in the prediction that, at the present rate of cutting, the fuel supply in these woodlots would be seriously depleted in a comparatively few years unless rehabilitation measures were undertaken.

It would seem a rational policy to couple education on quality improvement of the woodlot with that of replacing some imported coal by home-grown fuelwood. The people of Ontario import each year about twenty-five million dollars' worth of anthracite coal, mainly from the United States. A large portion of it is used by townspeople and farmers for fuel purposes, and this coal consumption is increasing. The census of 1940, as compared with that of 1930, records a decrease of twenty-four per cent in wood used as fuel on farms alone, while the value of forest products cut on farms during the same period dropped 26.5 per cent. The 1930 census recorded 3.9 million tons of coal imported into Ontario for domestic use; in 1944 imports increased to over 5 million tons.

During the depression years preceding the present war, the use of wood fuel increased to a very large extent. With the release of manpower after hostilities cease, and with improved transportation facilities, special inducements will be offered for utilization of our abundant supplies of wood as fuel, with great benefits to the provincial taxpayer and to provincial trade. Every cord or cord and a half of wood cut

means a day's labour and retains wealth for the province—the cost of a ton of imported coal.

Perhaps the chief reasons why coal supplanted wood for fuel in old Ontario were its relative cheapness and smaller bulk per heat unit produced, and the inability of the users to get wood plentifully, owing to the progressively decreasing availability of supplies. To restore the former position of wood fuel, it must once more be made plentiful and cheap, which objective might be effected by some of the following methods:—

(a) The devising of methods of furnishing fuelwood from other sources during the period of the rehabilitation of the ordinary farm woodlots. This supply might come from the forests (both Crown and private) of the Ottawa-Huron region. The aforementioned improved means of transportation made it possible for wood to compete with anthracite coal for fuel even at distances as great as one to two hundred miles by rail and fifty to eighty miles by motor truck under pre-war imperfect marketing conditions. It seems reasonable to expect that the post-war cost of transportation could be substantially reduced, under co-operative direction, in favour of the home-grown fuel.

It might be worth while to investigate the possibility of "hogging" wood, so that "waste" material, such as limbs and other culls, could be utilized as fuel in a form suitable for automatic feeding, and also to explore the use of briquettes, charcoal fuel, etc.

The cutting of the hardwoods on the forested lands north of the better farming districts would kill two birds with one stone. In addition to furnishing fuel supplies, it would effect desirable improvements in the stand, since in most cases the hardwoods are suppressing the young growth of the more valuable softwoods beneath them, so that such improvement cuttings would eventually become self-liquidating as to cost of the operations in terms of the increased value of the stand.

Returned soldiers might be given healthful work if employed, under supervision, to cut the fuelwood, and, again, such procedure would kill two birds with one stone.

(b) Another suggestion for furnishing wood supplies while the individual woodlots are being rehabilitated is the amplification of community forest projects where farmers and townspeople could cut wood for their own use on reasonable terms, to be agreed upon, and under the supervision of a forestry officer.

One of the strongest factors tending to establish permanency in the farming occupation is the raising of the economic status through addi-

Eastern Ontario was deeply flooded in post-glacial time. In many places waves cut shore-lines, washing away the finer materials and leaving large areas strewn with boulders. Much of this stony land is used for permanent pasture.

tional returns from the non-agricultural portion of the land. All farm land contains some low-grade soils, but the farmer, in general, has never looked much beyond the good soil for a source of income. The development of farm-forestry might be promoted by some of the following methods:—

(i) Marked extension of the farm woodlot demonstration work now being carried on by the Forestry Branch.

(ii) The encouragement of planting hardwoods, not conifers, in the open or unoccupied places in ordinary farm woodlots, and of planting hardwoods on the poorer grade farm soils. The report of the Dominion Fuel Board, previously referred to, presented data proving that the money return from the best woodlots, such as those in Waterloo County, was greater per acre than that from the tillable areas of many ordinary farms.

(iii) The studying of marketing problems with a view to increasing woodlot revenue to the owner by a more economical utilization of hardwoods. The majority of the farm woodlots yield little

revenue because the product is mainly fuelwood, whereas the farm woodlot is capable of giving a much higher yield if the farmer were educated to the possibilities of marketing. We import several million dollars' worth of wood material which, under economic marketing, could be provided from woods now sold as fuel—the lowest value in the scale of utilization. The establishment of small wood-using industries, at a low investment, within this region of settlement offers possibilities which might well result in the retention, for provincial circulation, of several million dollars annually. Any additional wealth accruing to farmers would preferably find its way to purchasing needed fuel supplies from northern woods, and not imported coal from foreign countries.

(iv) Development of efficient co-operative forest fire protection in some of the settled regions concerned is an essential requirement in any rehabilitation or management programme established.

It is suggested that the adoption of some such programme as that outlined above is necessary if we are to stabilize farm population; for, with domestic local fuel supplies fast vanishing, and the "bogy" looming up each year of a cash outlay of some $125 to $200 per family for imported fuel (an added expense, which is becoming harder and harder for the farmer to bear), it is evident that farm evacuation, under peacetime conditions, will increase.

In order to increase further consumption of fuelwood, it will be necessary to institute a general educational programme as an extension of farm-forestry education. This would include a systematic and well-organized campaign; the lining up of all co-operative agencies, such as public service organizations, boards of trade, county councils, farm boards, boy scouts, schools, etc., and also the press, journals and radio; the production of key motion pictures for theatre and lecture use; the preparation of leaflets of a type to promote economic utilization and marketing.

It is submitted that a fuelwood industry which offers potential development and consolidation of an annual home trade of from twenty-five to forty million dollars for perpetuity is at least worthy of full investigation.

GEOLOGICAL DESCRIPTION

Before proceeding with a brief description of the forest region, let us, for a few moments, study the geology of this area, as it is one of the major factors determining the region's potentialities.

Georgian Bay is the border zone between two geographic provinces which are quite distinct from each other, both physiographically and geologically. To the north is the Canadian Shield, composed of Pre-Cambrian rocks, while to the south is a lowland belt

developed on flat or gently dipping sediments of Palaeozoic age. The boundary between the two belts, though a fairly straight line on the map, is, in detail, a very irregular one. The Palaeozoic strata of the southern belt rest on Pre-Cambrian rocks similar to those exposed at the surface to the north, and at one time these sediments covered much more of the shield than they do at present. The erosion which stripped them off to the extent exhibited to-day has produced an embayed border where the overlapping sediments fringe out in an irregular manner, with, in places, outliers, or isolated patches of sediments, resting on the Pre-Cambrian to the north of the main boundary, and with inliers, or windows of Pre-Cambrian rocks, surrounded by Palaeozoic sediments to the south.

The northern belt is topographically fairly typical of the Canadian shield in general—that vast region surrounding Hudson Bay and comprising some two million square miles of Canada.

It is a region of hummocky topography, consisting of low rock hills and ridges separated by depressions commonly occupied by lakes or swamps. These features were produced largely as a result of continental glaciation in the Pleistocene period, when ice sheets overran the region, scoured off the country, and disorganized the drainage by eroding out valleys and damming stream courses through the irregular deposition of glacial debris.

The bedrock of the northern belt was formed early in the earth's history. It consists chiefly of granites and gneisses, minor amounts of basic intrusive rocks such as gabbros, alkalic syenitic rocks, and early Pre-Cambrian sediments, the oldest rocks of all, belonging to what is known as the Grenville series. The Grenville beds were formed as marine deposits; later, during mountain building movements, they were extended by the granites and other igneous rocks mentioned above, which altered and mineralized them. These intrusive rocks cooled at depths below the earth's surface, but later long-continued erosion wore the country down to low relief, destroying much of the Grenville rocks and exposing broad masses of the granites. It was over this eroded or pene-planed surface that the Palaeozoic was swept.

The Palaeozoic rocks of the border zone were deposited during the Ordovician period. They consist almost entirely of limestone deposited on the sea floor. In south-western Ontario these beds are covered by silurian strata, and the latter, in turn, by Devonian beds.

From the point of view of mineral deposits, the most promising areas are those underlain by the Pre-Cambrian Grenville sediments, expecially where these rocks are cut by the granite bodies. Minerals associated with the intruded and altered Grenville rocks include magnesite, talc, apatite, graphite, mica, garnet, feldspar, molybdenite, etc. Corundum is associated with syenitic rocks in the counties of Renfrew, Hastings, and Peterborough. Veins cutting the Pre-Cambrian rocks, and also, in places, the younger Ordovician strata, carry barite, fluorite, celestite, and galena. Other mineral products of the region include crushed marble for chicken grit and for the production of terrazzo flooring, and crushed rhyolite and basalt for roofing shingles. In fact, the great variety of the non-metallic minerals make the region a most interesting one to the mineralogist and prospector.

General Description:

Region: The region includes the Ottawa-Huron forest districts and settlements south of these forests, or that area lying south of the French and Ottawa rivers.

Population: The population of Ontario reported for 1941 was 3,787,655, with about ninety per cent concentrated in the region under discussion.

Distribution of farms: The region of acute fuel shortage where imported fuels are used about fifty-fifty with home wood-fuel is concentrated in thirty-three counties, which contain seventy-three per cent of the farms; a further sixteen per cent is located in ten partially settled counties south of the forest district.

Forest conditions:

(a) Forest districts—In the forest districts of southern Ontario included in the Trent, Parry Sound and Algonquin inspectorates, we have an area of about 12 million acres, or ten per cent of the provincial forest area. Forest-condition surveys, made by the Ontario Forestry Branch and the Commission of Conservation, have reported on 10 million acres of this region. The late Dr. Coleman also made surveys, following which he designated the region as "entirely unsuited to agriculture and useful only for forest growth". We find, however, approximately 2.5 million acres under some form of agricultural development, leaving the balance of 9.5 million acres for forest growth. About 3.2 million acres in the region are still held under licenses for the remaining pine, pulpwood and hardwoods.

Recent reports of forest conditions are not available. A study made some ten years ago, however, provides approximate information concerning forest type distribution, according to which there was 46 per cent hardwood and mixed combined, 4 per cent coniferous, 50 per cent forest fire types (of which 39 per cent was poplar-birch, 2 per cent recent burn, and the remaining 11 per cent rock barren). The age class distribution is also informative: namely, 22 per cent mature, 12 per cent severely culled, 19 per cent second growth, 34 per cent young growth, 2 per cent burn, and 11 per cent barren. It is significant to note that persistent marketing of only red and white pine in this region has brought about the steady conversion of mixed types to pure hardwood types. Conifers develop best in mixed stands, which again are more resistant to insect depredation. The desirable persistence of mixed stands is dependent upon markets being found for hardwood utilization.

(b) (i) Settled districts (woodlots)—The Dominion Fuel Board provides information as to forest conditions in the various counties of southern Ontario in relation to fuelwood production. The area of woodlots in the fully-settled parts is given as 2,310,000 acres. There exists a wide range of conditions, practically all of which are most unsatisfactory. We find farmers in the fully-settled region, containing over three-quarters of the population, cutting at a rate of three to thirty times (an average of five times) the annual growth. Further, this excessive cutting has been going on for decades, and supplies about eight out of every nine cords

Submarginal agriculture on the sand plains. Every effort should be made to get these areas back under pines—the one crop which they produce to perfection.

of the fuelwood cut of the province. The present condition of this one-time wooded region, certain sections of which previously supported wood crops running as high as 100 to 125 cords to the acre, shows the inevitable results of overcutting without regard to restocking. On eleven million acres of fully-settled lands are woodlots averaging 7.6 acres and containing 11.4 cords per acre. There are a few exceptions where conservation measures have been practised—notably Waterloo county, where woodlots containing one hundred cords to the acre may still be found. We find, further, that not only are the woodlots too small and lamentably understocked, but that over fifty per cent in the fully-settled counties are stocked with *mature* trees, over a third of which are *not* regenerating. The fuelwood survey determined that the woodlots in thirty-three counties of this settled region would be seriously depleted within a few years unless rehabilitation measures were undertaken.

(b) (ii) Settled districts (wastelands)—We have in this same region over 2 million acres classified as unimproved and unwooded—waste land used for uneconomic pasturage. Such lands form part of the farm and provide potential areas for economic planting to hardwoods and extension of woodlots. This is shown by a survey made by the Ontario Agricultural College, which determined that the use of these lands for pasturage provided but one-third of what their utilization for growing wood crops would produce.

Economic factors:

(a) (i) Fuel supplies (forest regions)—The fuelwood resources of the Ottawa-Huron region have been briefly indicated in a previous section. We have possibly 3 million acres of mature hardwoods from which, under management, we could utilize the imperfect, ill-formed and diseased trees, discards of the operator, which, nevertheless, form a potential fuel supply of some millions of cords. We have, in addition, about 2 million acres of second and young growth which, under forest management, would release several million cords for fuelwood. We have also 3.3 million acres of poplar-birch forests as a further field of fuelwood supply. There is, therefore, a vast reservoir of fuelwood here to meet any conceivable fuelwood-utilization programme that can be promoted in the interests of using home-grown fuels and provincial labour in place of imported fuels and foreign labour. An army could be profitably used here, and, under forest management, could double the yield per acre.

(a) (ii) Fuelwood supplies (settled region)—Woodlands and forest tracts within the settled region total about 2.3 million acres. The average acre now contains possibly eleven cords or less. The growth rate in these forests is twenty per cent or less of what the same land could produce under management. The present cut is about one cord per acre per year, or five times the growth.

About one-third of the woodlots are not reproducing, due, mainly, to the grazing of cattle. Regeneration in these woodlots could, therefore, be accomplished with little expenditure of time or money, and would result in a yield improvement of possibly half a cord per acre. With proper forest management, however, the same lands would produce a cord or more per acre. This practice would involve expense, mostly in the form of labour, but every acre so managed would save the farmer just that much outlay which he now makes for imported coal.

To sum up the economics of the question: We have seen that the supplies of wood in the forest districts are ample; that supplies in the woodlots are inadequate to meet domestic fuel requirements, and further, that the woodlots in thirty-three counties are seriously depleted; that the use of wood for fuel is only curtailed by diminishing supplies in settled regions where most of the present fuelwood is cut and consumed; that the percentage of woodlot area in relation to occupied farm area is too small to meet future domestic fuelwood requirements; that ample areas within the occupied farm area are available which could be most profitably used in woodlot extension. We also know that the heating value of 1.2 cords of the best fuelwood equals that of one ton of the best anthracite coal; that coal importations will increase unless woodlots are rehabilitated or supplies of fuelwood provided; that improved trans-

portation facilities and co-operative marketing make possible supplying home-grown fuel from northern forests to southern woodlot owners and townspeople at less cost than that of equivalent imported fuel; that farm-forestry and improved marketing will stabilize farm-settlement and, finally, that the fuelwood project advocated offers great possibilities for putting many thousands of unemployed to work on a constructive programme which will be self-liquidating.

In considering a plan of reconstruction for the region under discussion, it is, I think, important to keep in mind that southern Ontario contains about a third of Canada's population, and is adjacent to many millions of actual and potential visitors who live south of the border. It is a region of developed and developing transportation facilities; a region of lakes which will permit the use of aircraft; a region where we know that forest fires can be controlled; a region of accessible forests, water power, fish and game, scenic and mining resources.

Mr. Leslie, in his paper delivered in 1943, mentioned a few of the improvements necessary to make the Tweed Inspectorate operate more effectively—such as road building, surveys of various types, mapping, etc. He felt that 1,000 to 1,500 men could be profitably employed for a two-year period. The Tweed region constitutes about one-third of the Ottawa-Huron area under discussion; thus, work of this character alone would provide employment within the forest regions of southern Ontario of possibly four to five thousand men for two years. If, however, the fuelwood plan suggested is put into operation, five thousand or more additional men can be employed profitably for many years.

Mr. Crosbie, District Forester of the Tweed Region for seventeen years, stressed at the same meeting the primary need of adequate forest fire protection—and I would couple with this the need for adequate forest insect and disease control. These are requirements I cannot emphasize too strongly as fundamental for the success of any conservation plan. Mr. Crosbie's recent statement to me regarding the efficacy of the system of fire protection inaugurated in 1922 is reassuring; the population has been stabilized, woods employment has increased, and the tourist industry has grown phenomenally as a result of comparative freedom from the forest fire menace.

In connection with any reconstruction plan which may be adopted, I would like to state that, in my opinion, the Forest Service has done remarkably fine work with the moneys at their disposal. They have, however, been seriously restricted by lack of adequate funds. They have the nucleus organization to get on with the task, but, in order to obtain the best results, must have the requisite public support, and must

be assured of adequate funds, of a great increase in trained forestry personnel and of freedom from political interference.

Conclusion:

For the past five years and more, we have experienced the difficulties of operating under the burden of manpower shortage. At the close of the war, this will be lifted, but, unless we plan, and plan well, we shall then have to carry the more onerous burden of a *surfeit* of manpower. The period of readjustment offers an unusual opportunity for putting our conservation house in order. House-cleaning will require an abundance of manpower if the job is to be done thoroughly and expeditiously, and it will be work in the great healing outdoors—a health-rehabilitation project carried out in the midst of an ideal recreational area, with home, under modern transport conditions, just around the corner. There will be employment, temporary and permanent, for all kinds of technicians where their active-service training can be turned to immediate and good account, for here is offered a continuing use of trained personnel, of established military camps and air stations, and of equipment and stores no longer needed by the services—in the logical sequel to a War to save Democracy—a Royal Battle for Conservation that would make good reading in our history of stewardship.

Here, to my mind, is the type of memorial in the building of which men who have fought for a better way of life would find real satisfaction.

DISCUSSION

MR. W. M. ROBERTSON, DOMINION FOREST SERVICE: Congratulating Mr. Dallyn on his very excellent presentation of the forest angle of the question, there is one point I would like to stress. That is the question of marketing. Mr. Dallyn referred to fuel wood production almost entirely. We have need for diversified markets. There are other products than fuel wood which bring greater returns to the farmer.

For example, there was a few years ago a demand for elm for veneer work. There was plenty of it to be found or at least a lot to be found, but the farmers didn't know the value of it. They didn't know how to produce it.

On farm products of other sorts the radio broadcasts a daily market of farm products, other than wood, but there is a very great lack of such a market presentation of forest products. The farmer should be advised, not only of the value of the products, but how he can market them and how they can be produced.

I might add that the Department of Agriculture has realized that the woodlot has a vital place in the farm economy and they now have asked the Dominion Forest Service to cooperate with them in establishing demonstration woodlots referred to by Dr. Graham last night, as the first essential in this economy. These woodlots are to be managed on a woodlot management plan.

The Service is making a survey of the woodlot, determining the increment of it, and showing how they should mark it—the older, mature and defective stock first and then subsequently to increase the production from half a cord per acre per year to at least one cord per acre.

That wood at the present time is worth $8.00 a cord on the road-side. A half a cord brings $4.00 per acre. I question if many other products give more than $8.00 per acre per year, continuously, without any other expense other than harvesting.

MR. CECIL IRWIN, CARNAVON, ONTARIO: Mr. Dallyn spoke about the owners of some of the border forest lands being more interested in the mine that may be there

than in what is on the surface. There are quite a number of districts where this state of affairs is quite a problem, where different parties who have land which has been burned over are taking no interest in it, while a neighbour may be cherishing a carefully-managed woodlot. There seems to be no guarantee that the latter's efforts are going to be protected in any way. It is alright to say that if a fire starts on a neighbour's land he may be assessed with the cost of fighting that fire, but I have a case in mind now where, last year, a fire started on a settler's land, and very little was done about it. There was a valuable piece of timber being looked after close by. When questioned as to his responsibility this settler's answer was, "Well, what can they do to me? I ain't got nothing."

There are a great many areas in the Trent Valley where such is the case, where people who own land are making no effort to protect it. If a fire gets going it is alright to say that if it comes to your land you will protect it. If it comes to your land with a face a mile or half a mile wide you just can't stop it.

I am wondering when we are going to come to the point of doing something about control of such lands. It seems to me there will have to be a point reached before long where the municipalities or counties take a hand in organizing an efficient protective system and levy a tax to cover the cost.

I know a case where a number of square miles were burned over. It started on privately-owned land and no proper effort was made to control it. It burned a great deal of adjacent wood land until finally checked by rain.

I think that this is a question that deserves a great deal of thought. In the Upper Trent Valley in Haliburton County there are the original holdings of the English Land Co., privately owned, with no organized fire protection at all. Formerly nine townships in extent, there are now about six townships of 81 square miles each involved.

If a fire starts there, the Government protective service does not cover it. Much of it has been slashed this year as never before—and is all ready to go when the first careless person sets it off. What can the neighbours do that are trying to look after their property?

MR. DALLYN: I think Mr. Irwin has raised a very vital point. This has been going on for a great many years. All through this region you are faced with that problem of scattered wood-lots, privately owned, and abutting them is Crown land. The owner or someone should take the responsibility for fire protection on these privately-owned woodlots.

Then, as I mentioned before, we have the absentee party who is away from his property and is only concerned with what might be there in the way of minerals. I don't think we will ever get the efficiency really required until we tackle that problem and solve it.

MR. ELMER DAVIS, KINGSTON, ONT.: I would like to make a reference to another thing that I think is equally hazardous, and equally needs attention, and I am glad to do it because of the presence of the honourable gentlemen here this morning.

I am thinking of a concrete case where I have hunted for thirty-five years. When I first went there it was one of the finest hardwood stands you could find anywhere in the Province of Ontario. Now, with the advent of a highway and with truck transportation available, cutting has gone on for the last four years. I was appalled when I went in this last fall to find that there has been not only no attempt to take care of the situation left by the bushman—slash is lying everywhere—but there has been no attempt in the cutting to protect the young growth. Promising hardwood trees, three, four, six inches through are smashed down, left lying there. No protection whatever.

This is on government and privately-owned land, and being cut by men operating under government license. It does seem to me that here is a thing that needs attention, and I am given to understand by men in that area who know, that what prevails there also prevails across the country, and what we saw there is not an isolated case by any means.

I think if we are serious about conservation there should be some further restriction and enforcement with regard to the method of cutting and the preservation of the young growth and the elimination of fire hazards as far as possible from the cut-over areas when the timber is removed.

If when the spring rain is over and things dry up this spring in the area I speak of, somebody throws down a cigarette butt, there will be a conflagration that will clean off a great many thousand acres in that area.

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DOMESTIC WATER SUPPLY—URBAN AND RURAL PROBLEMS

John Wyllie, M.D.
Professor of Preventitive Medicine, Queen's University

ONE of the great achievements of civilized man is the provision, for human use, of abundant, convenient and reliable supplies of water of good quality. Indeed, the improvement in the quality of public water supplies has been a major factor in increasing the average length of human life. However, considering the less advanced sections of Canada, it is evident that the task is still far from being completed.

The Public Water Supply:

The water that is of principal concern to man is the land water which includes the *surface* water, i.e., the water in the lakes and ponds, in the streams and rivers, and the *ground* water, i.e., the water that forms the soil moisture and the water in the rocks that supplies the springs, streams and wells. Any natural or artificial change that increases the supply of land water where it is needed, eliminates it where it is destructive, improves its quality or extends its availability is a distinct human advantage; any change in the opposite direction means human impoverishment. As all these sources of water supply are subject to pollution of various types as a result of every-day life, protection or purification is necessary to ensure safety. The problems of water supply and sewage disposal are therefore so closely interrelated as to require joint consideration in schemes for municipal sanitation and in the protection of our streams and waterways. It is suggested, therefore, that in local administration *one* department should be concerned with the double problem of water supply and sewerage, although it has been customary to have separate departments.

In Great Britain, lakes used for water supply are usually situated in upland country. They are natural reservoirs fed by the streams which come down from the encircling mountains. The outlet of the lake is often raised to increase the storage capacity, and the available yield of water is based on the area of the gathering ground or watershed, the available rainfall and the storage of the lake which can be drawn upon. Such upland lakes usually furnish *pure* supplies.

The following are typical examples: (1) Glasgow takes its water supply from Loch Katrine by two aqueducts, each approximately 25 miles in length and leading to two service reservoirs which are situated

The ideal source for domestic supply is a well-protected lake or river. Rainy River below Long Sault Rapids.

about seven miles from the city. The two aqueducts, taken together, are capable of discharging 110 million gallons daily into the two service reservoirs. The water from Loch Katrine undergoes neither filtration nor chlorination, being merely strained through fine wire-gauze screens to prevent twigs and leaves from passing into the pipes. (2) Manchester finds a sufficient supply in Lake Thirlmere in the Lake District of Cumberland, 90 miles from the city. (3) Liverpool has found an abundant supply in Lake Vrynwy in Wales, 68 miles away.

Examples of impounding reservoirs are also frequent. They are constructed by building a dam across the outlet of a fairly wide valley bounded up steep hill slopes at the side and collecting the water flowing down the stream or river for storage purposes. This *ideal* water supply system can be seen in several Canadian cities, particularly on the eastern and western seacoasts. The lower sections of the stream or river and often another watercourse can be utilized for the discharge of a sewage effluent under proper safeguards. Examples of this ideal arrangement are found at Campbellton, Bathurst, Chatham and Saint John in the province of New Brunswick and at Quebec City, Sherbrooke, Rivière du Loup, Rivière à Pierre and Sutton in the province of Quebec.

TABLE SHOWING A FEW SELECTED CANADIAN CITIES UTILIZING LAKES OR STREAMS FOR IMPOUNDING RESERVOIRS AND USING ANOTHER WATER-COURSE FOR DISCHARGE OF SEWAGE AFFLUENTS

CITY	Population 1941 Census	Source	Nature of Catchment Area	Treatment	Sewage Disposal Into
Province of New Brunswick					
Campbellton	6,748	Small lake	Protected	None	Restigouche River
Bathurst	3,554	Small lake	Protected	Chlorination	Bay of Chaleur
Chatham	4,082	Small lake	Protected	Chlorination	Miramichi River
Saint John	51,741	Spruce Lake, Loch Lomond, etc.	Protected	Chlorination	Bay of Fundy
Province of Quebec					
Quebec City	150,757	St. Charles River and Lake	Not Protected	Chlorination	St. Lawrence River
Sherbrooke	35,965	Magog River	Not Protected	Chlorination	Magog River
Rivière du Loup	8,713	Small lake	Protected	None	St. Lawrence River
Rivière à Pierre	634	Small lake	Protected	None	Small river
Sutton	1,118	Mountain stream	Partly protected	Slow sand filtration	Small river

The great fresh-water lakes of North America, which lie between Canada and the United States, present a *different* problem. Most cities on their shores take their drinking water from the lake into which their sewage is discharged. The Great Lakes (Superior, Michigan, Huron, Erie and Ontario), with their connecting rivers, are the sources of domestic water for millions of inhabitants on their shores as well as for thousands of persons engaged in travel or navigation on them. But these sources have been subjected for many years to pollution from

(a) industrial wastes from mines, paper mills, tanneries and chemical plants,
(b) sewage from many municipalities, and
(c) vessel sewage and unrestricted discharge of vessel ballast water which is usually grossly polluted.

A city or town proposing to use such a lake or river as a source of water supply must ensure protection from water-borne diseases—typhoid fever, paratyphoid fever, amoebic and bacillary dysentery, infectious jaundice and non-specific gastro-intestinal disturbances.

Safe Loading of Water Purification Plants:

In practice it is easier to safeguard a lake or river water supply by purification at the intake than to sterilize the sewage at the numerous

outfalls en route. The question at once arises as to what is the treatable limit, i.e., how bad must a polluted water be, judged by bacterial or other tests, before it is classed as incapable of being made fit for potable purposes by current large scale methods of water treatment? An answer to this question was given by the International Joint Commission on Pollution of Boundary Waters (1918), which expressed the view that communities discharging sewage into rivers should purify it so that the resulting average cross-sectional pollution in each river would not exceed the limit of safe loading for a water purification plant. A mean annual cross-sectional count of B. coli not exceeding 500 organisms per 100 cc. of water would comply with this condition. This was before the general use of chlorination. The subject has been reopened by Streeter who completed a comprehensive survey of the permissible loading on water-treatment plants in 1939. His findings are that a concentration of B. coli greater than 50 per 100 ml. is not permissible for cities where chlorination is the sole defence against polluted water supplies, but with modern treatment plants that a limit of 5,000 B. coli per 100 ml. is allowable.

The types of pollution encountered in waterways may be divided into two groups: (a) *pollution which directly affects the public health*, e.g., excessive pollution from sewage and industrial wastes of the sources of public water supply, edible shellfish-growing beds and bathing beaches, and (b) *pollution which indirectly affects the public health*, e.g., conditions (i) giving rise to a "nuisance" or adversely affecting the value of bordering property for residential, agricultural or recreational uses, (ii) affecting the maintenance of fish life in lakes and rivers, and (iii) causing abnormal tastes and odours in public water supplies.

Self-Purification:

Just as nature has provided that after the death of all living matter, decay and decomposition set in until the products are converted into stable substances, so has it provided a process of stabilization of the waste matter eliminated by living beings, and a *self-purification process* of our natural bodies of water. This self-purification process consists essentially of sedimentation of suspended solid material, stabilization of the decomposable organic matter by supplying a sufficient amount of oxygen, the final destruction of disease-producing bacteria by exposure to an unfavourable environment as to food and temperature, the liberation of malodorous gases and the absorption of further oxygen produced by reaeration. There is no rule by which we attempt to measure this rate of self-purification. Obviously, dilution is one of the chief factors. To overburden a stream or other body of water with gross polluting material and expect safe and attractive water to be immediately returned is expecting nature to do more than its share. The burden of self-

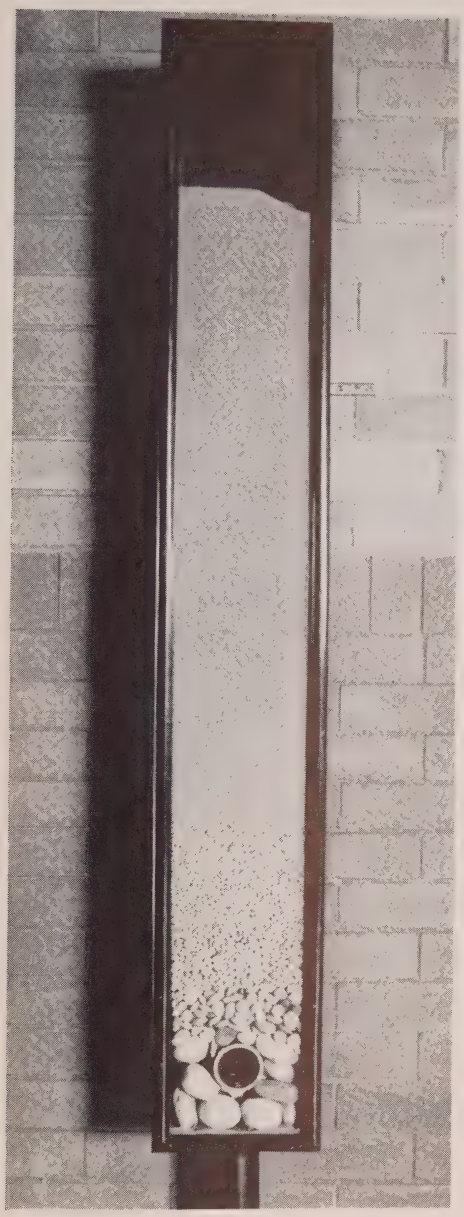
purification in the receiving waters, of course, can be almost entirely or appreciably relieved by methods of water purification and treatment of the sewage or other waste matter before it is discharged. Since man depends upon adjacent bodies of water to act both as a transporting and purifying agent for his wastes, he is called upon to aid in the cycle of treating the waste material and purifying the water he drinks by artificial means, if hygienic aspects are to be adhered to and injurious effects avoided. Only those surface sources of water supply which exist outside the influence of human habitation or are protected against possible contamination remain beyond the suspicion of health authorities as being safe for human consumption without purification.

Water Purification:

As may be concluded from the foregoing, the chief purpose of purification of water is to render it safe for drinking, first, by the removal of solid substances which carry the harmful bacteria and on which the bacteria feed; and, secondly, by destroying the remaining bacteria which have become separated from the solid matter and have not been previously removed. Other purposes of purification, by no means of minor importance, are to produce a water supply which is attractive to the senses of sight, smell and taste by removing substances causing colour and turbidity, liberating entrained gases and reducing the content of other dissolved matter which cause objectionable odour and taste. Purification also can produce water which is satisfactory for industrial and other household purposes by controlling the chemical character of the water in regard to hardness and corrosion.

Briefly, the process of purification is accomplished by the following methods which are commonly employed: plain sedimentation or sedimentation aided by coagulation, rapid sand filtration and sterilization. Some of these processes are used singly or in combination with others, but complete treatment involving the rapid sand filtration method would include all of the processes mentioned. Frequently, aeration is included, being the first step in the complete treatment process, and is adopted to get rid of excess carbon dioxide and sometimes hydrogen sulphide and iron.

Sedimentation aided by coagulation is accomplished by adding certain chemicals to the water to form an insoluble, gelatinous, flocculent precipitate, which, in its formation and slow settling in the water, entangles and entrains the suspended and colloidal organic matter, thus hastening its sedimentation. The addition of a coagulating chemical serves also to remove colour, odour and taste from the water. Sedimentation with coagulation is a preliminary step to prepare a raw water for filtration through a rapid sand filter. In practice, the method consists



Typical section showing construction of sand filtration bed.

of mixing the coagulating chemical with the water in sufficient amount to produce the required precipitate and then allowing the water to stand quietly in or to flow slowly through a settling basin in which the coagulant is harmless to the consumer. The most widely used coagulant is aluminium sulphate, commonly called "filter alum," which reacts with the natural or induced alkalinity of the raw water.

The common method for the filtration of water is to pass it rapidly through a layer of sand. By this action suspended matter is removed, colloidal matter is partially removed, the chemical characteristics of the water are changed and the number of bacteria is materially reduced. The total result of these changes is the production of an attractive water in which the bacterial content has been reduced 98 per cent approximately.

Chlorine is by far the commonest agent used for sterilizing water. It is applied to filtered water to destroy the remaining two per cent of bacteria. Chlorination is not a substitute for filtration: it is merely a safeguard against disease. To replace entire dependence upon the chlorination of polluted surface water to produce a safe drinking water-supply is to rely too

much on one method of treatment, which does not remove other foreign matter, and to be confident that mechanical mishaps or other interruptions will not occur. Such an unfortunate situation continues to exist in this city, although there is a post-war prospect of its remedy. Purity and safety are distinct connotations in Public Health. A polluted water can be made safe by chlorination so far as pathogenic bacteria are concerned but purification in the sense of the removal of suspended and colloidal organic matter, improvement of the chemical characteristics of the water and substantial reduction in the number of viable bacteria is not effected.

Water-borne Diseases:

Water-borne diseases may be due to the presence of (1) inorganic salts or mineral substances in the water, such as excessive amounts of sulphates, fluorides or suspended particles of clay, (2) vegetable matter, and (3) ova of intestinal parasites such as the round worm (ascaris) and the threadworm (oxyuris). These conditions are characterized for the most part by gastro-intestinal disturbances associated with diarrhoea. The most important group of water-borne diseases, however, is that due to specific organisms such as the cholera vibrio, the typhoid bacillus, the dysentery bacillus, the parasite of amoebic dysentery and the leptospira of infective jaundice.

In Canada during the seven-year period 1930-36, there were 33 water-borne outbreaks of typhoid fever, diarrhoea and dysentery. Ontario had the distinction of not having a water-borne outbreak during 1930-36 as compared with 17 in the decade 1920-29. Although there has not been an outbreak of typhoid fever due to a public water supply in Ontario for the last 22 years, serious water-borne outbreaks do occur in other parts of the world. Medical Officers of Health and Public Health Engineers watch them closely in order that the lessons which they teach may be applied to public health practice in this province, in the hope that no such practical lessons may have to be learned at our own expense.

Let me give you a recent example: Minneapolis suffered an epidemic in the summer of 1935 in which there were 174 cases of typhoid fever and six deaths. A very careful and detailed report of the circumstances of this epidemic has recently been published. Three circumstances make it almost certain that this epidemic was due to the water supply: (1) the suddenness with which cases of typhoid fever appeared; (2) their appearance in widely separated parts of the city; and (3) the failure to find any other common source of possible infection among the patients. The cases were predominantly in the western half of the city to which water is supplied from one of two treatment plants. The records showed that the free or residual chlorine from each of these plants had reached a

dangerously low level of 0.03 to 0.1 p.p.m. during the period of the epidemic, but samples taken for the examination of B. coli had at no time failed to meet the required standards. This led to a laboratory study of the chlorine resistance of the typhoid bacillus and various members of the colon group of bacteria. It was found that the chlorine resistance of different strains of the typhoid bacillus varies considerably, and that some of these strains have a higher chlorine resistance than many members of the colon group studied. The moral to be drawn from this epidemic seems to be that our reliance on the accepted standards of purity on the basis of B. coli counts is greater than it should be.

Protected Public Water Supplies in Ontario:

Information obtained from data compiled and published by the Canadian Section of the American Water Works Association, as of June, 1937, and January, 1938, reveals that in the Province of Ontario there are 241 public water supplies used for potable purposes, serving a population of 2,227,530 or about 60% of the total population of Ontario. One hundred and twenty-eight of the 241 supplies are derived from surface sources, like rivers and lakes. Approximately 48% of the surface supplies are filtered and chlorinated, 43% are only chlorinated and 9% received no treatment. It is desired to point out, however, that the 48% representing 61 surface supplies which are filtered and chlorinated, serves better than 70% of the total population having the advantage of a public water supply in Ontario. Of interest also is the fact that 15 of these surface supplies are derived from Lake Ontario and serve approximately *one million people.* Twelve of the 15 supplies are *filtered and chlorinated.* Ninety-seven per cent of the *million* people who are dependent upon the use of Lake Ontario as a source of public water supply in the Province of Ontario are served with filtered and chlorinated water.

DISCUSSION

MR. WILLIAM STORRIE, TORONTO: Mr. Chairman, I have listened with a great deal of interest to Dr. Wallace's paper. I think there is one thing that should be brought out when he compared the water supplies of the Old Country with some of them in this country.

The point we want to make is that where the water supply is derived from a lake system or impounding reservoirs in the Old Country, the gathering ground on which the rail falls has extremely close protection. It is invariably owned by the Municipality. Grazing is allowed but no farmer on that gathering ground is allowed to house cattle in any building.

It is because of this that I have found in this country extreme difficulty in getting the authorities to realize the difference between many of the water supplies in the Old Country and the taking of the source of supply in this country from the Great Lakes system. The conditions are almost entirely different and if purification of water is needed in the Old Country it is more from the point of view of straining out suspended matter or removing turbidity from the source of supply.

It has always seemed to me a great pity that we have failed to realize the tremendous heritage which any municipality has which takes its water supply from the Great Lakes system. It has been estimated that more than half of the known water supply on the surface of the whole earth exists in the Great Lakes system and we have abused this great natural resource by polluting it to the best of our ability.

I think, Dr. Wyllie, if I may make you a suggestion, should have completed the story about the city of your adoption. Kingston has taken certain steps to remedy the conditions you referred to, so far as their water supply is concerned. They had a by-law prepared for the people to vote on, on what was practically a new source of supply, but that was withdrawn on the outbreak of the war. They have, however, in the interval built a new intake pipe considerably upstream from the old one, and they are getting ready to proceed with a water purification plant.

That raises another point whether or not we should purify the sewage before purifying the water. To me it is absolutely obvious you should adopt the first line of defence and construct a water purification plant before putting in a sewage treatment plant. Because of land drainage and pollution coming from sources other than out of sewers that cannot be effectively treated, then the first line of defence is to purify the water.

I would like to make a slight reference or two to the Ottawa plant which Dr. Wyllie dwelt on at length. That is an exceedingly difficult water to treat. You can't say you are going to treat Lake Ontario water exactly the same as the Ottawa River water. The Ottawa River is an entirely different type of water from Lake Ontario.

As you know, they had two typhoid epidemics which caused many deaths and they brought experts from the Old Country who recommended that they go to the Gatineau Hills. The cost was too great. They finally called in engineers to see what could be done with the Ottawa River and realizing the difficulty of the problem those engineers refused to attempt to purify this water without first of all building two filter plants for experimental purposes and operating them for a year.

The result of putting in those trial filter plants was just a revolution so far as water purification is concerned, and the plant at Ottawa, as it now exists, was built largely as a result of the experimental work carried out at that time.

One of the difficulties is that to get the same results you can treat water generally from Lake Ontario with a half grain of alum per gallon whereas you cannot begin to treat it under two and a half grains in the Ottawa River. In other words, the chemical cost on the Ottawa River supply is at least five times that of Lake Ontario water.

Dr. Wyllie made slight reference to dental caries and the treatment of water with fluorine. I don't think that has been done in this country so far. There is evidence that shortly the City of Brantford is going to try to treat the water to see what effect it will have on the question of dental caries and if that is so the result will be looked forward to with great interest.

I would like again to thank Dr. Wyllie for the very interesting paper.

8

"NATURAL REGIONS OF EASTERN ONTARIO"

Dr. D. F. Putnam
Department of Geography, University of Toronto

IT IS a great pleasure to stand within the historic halls of Queen's University and to experience the warm welcome which has been extended to the participants in this Conference. This institution has always stood for progress and has always been solicitous for the welfare of her own particular constituency; it is entirely in accord with this policy that she should provide facilities for the Conference on Conservation in Eastern Ontario, sponsored by the Department of Planning and Development. I commend the public-spiritedness of Principal Wallace and his staff, as well as that of the Honourable Minister and his assistants.

I have listened with great interest to the current discussions and I have been pleased to note a strong thread of geographic reasoning running through them all. It is, I think, patent that we can fully understand our natural resources only when they are comprehended in their geographical setting. This is somewhat difficult, however, especially when dealing with any large area of the earth's surface.

In order to facilitate geographic discussion, geographers have long ago adopted the expedient of speaking in terms of regions. Disregarding the works of man, the earth may be thought of as a mosaic of natural regions which differ from one another in their various features. Regions may be delimited on the basis of many criteria, such as climate, vegetation, land form, etc. It is often hard to establish boundaries for regions since they tend to grade into one another. They may be described on the basis of their nuclei or core areas; that is, the central and most distinctive locality may be said to characterize a region. More often than not, the boundary may lie in an indefinite zone amongst features which belong to the adjoining region as well as to the one under discussion. There are, of course, many definite boundaries, usually of a geomorphic character. The edge of the Canadian Shield, in most cases, is such a boundary.

Regions may be of any size—the larger the better—but large ones are found almost invariably to be capable of division into smaller ones. Geographers have several names for these minor regions, but it is not my purpose at the moment to define the various classes of regions. They exist, and it is possible to note them when traversing the country or

The sugar maple is well adapted to the soils of the limestone plains and rolling lands of Eastern Ontario where it forms an important element in the original vegetation. Some of the counties of Eastern Ontario are outstanding centres of maple syrup production.

studying a map. In our own country, at least, these minor subdivisions may be pretty closely related to land forms and soil materials. I have made the statement, and I reiterate it here, that the soil is the best single index to the character of a natural region which the geographer is likely to find. The ensuing discussion will, therefore, be centered upon the various land type areas delimited on the basis of land form, materials and soils.

Eastern Ontario is a concept, nearly as hard to define as that of the natural region. From a geological standpoint, there is a definite unity to the area lying east of the Frontenac axis.[1] There are other factors to be considered, however. Space relations, cultural and commercial contacts, and historical background combine to add considerably to the area of Eastern Ontario. People in Hastings County and even in Peterborough, think of themselves as belonging to Eastern Ontario. In the course of the following remarks reference will be made to the whole territory from Rice Lake to the Ottawa River. Perhaps I am being influenced unduly by the focal position of the City of Kingston. At any rate, it will be seen that there are points of similarity between the areas

[1] Wilson, A. E., J. S. Stewart and J. F. Caley. Sedimentary Basins of Ontario Possible Sources of Oil and Gas. Transactions of the Royal Society of Canada. Third Series. Vol. XXXV, Sec. IV, p. 167-185. 1941.

lying to the east and to the west of this city. It will also be evident that Eastern Ontario is not in itself a natural region, but consists of portions of two of the important physiographic provinces of North America.

At this point, by way of explanation and acknowledgment, it is well to mention that this discussion is based upon observations made in the course of field work under the auspices of the Ontario Research Foundation and conducted at various times during the past decade in company with Mr. L. J. Chapman, who shared equally in the labours of investigation, but must not be held responsible for any inadequacies in the present method of presentation. Much further information is recorded elsewhere.[1]

SURFACE FEATURES

Geographic method embraces the examination of all facts connected with a region. The most obvious of these are phenomena of the surface itself; the hills, valleys, plains, rivers and lakes which give it character. Eastern Ontario possesses two distinct types of landscapes. There are the rough rocky hills and ridges of the shield which become lower and somewhat subdued in the narrow neck of the Frontenac axis lying between Kingston and Gananoque, and on either side of it plains of much more gentle relief.

The area to the east, often called the Ottawa Valley, has very low relief, most of it being below 250 feet in elevation. In contrast with it the edge of the Laurentian upland rises abruptly to the north of the Ottawa River. Only a few low hills and ridges break the flatness of this plain. Above Arnprior, the valley becomes much narrower and is bordered by steep slopes in both Ontario and Quebec.

To the west of Kingston the plain is somewhat more elevated and is cut by the steep sided valleys of numerous streams flowing into Lake Ontario. Much of Prince Edward County appears as a flat plateau one hundred and fifty to two hundred feet above the lake.

West of the Trent River the terrain becomes really hilly reaching elevations around 1,000 feet. Here we find a great abundance of oval hills extending in a northeast-southwest alignment, but the greater

[1]Reference may be made to the following papers:

D. F. Putnam and L. J. Chapman. The Physiography of South Central Ontario. Scientific Agriculture 16: 457-477. 1936.

L. J. Chapman and D. F. Putnam. The Soils of South Central Ontario. Scientific Agriculture 18: 161-197. 1937.

L. J. Chapman and D. F. Putnam. The Physiography of Eastern Ontario. Scientific Agriculture 20: 424-441. 1940.

L. J. Chapman and D. F. Putnam. The Soils of Eastern Ontario. Scientific Agriculture 22: 608-636. 1942.

D. F. Putnam and L. J. Chapman. The Drumlins of Southern Ontario. Transactions of the Royal Society of Canada. Third Series. Vol. XXXVII. Section IV, p. 75-88. 1943.

elevation is to be found in the high sandy ridge that lies between Rice Lake and Lake Ontario. The Trent River pursues an extremely zigzag course in order to get around this hilly belt. North of the Trent, also, the land is somewhat hilly though of gentler relief than in the vicinity of Rice Lake.

The general aspects of the surface form or geomorphology of the region are shown in Figure 1. It must be remembered, in interpreting this diagram, that it deals in symbols only; the hills are not drawn to scale, but represent the type of hill to be found in the area.

BEDROCK GEOLOGY

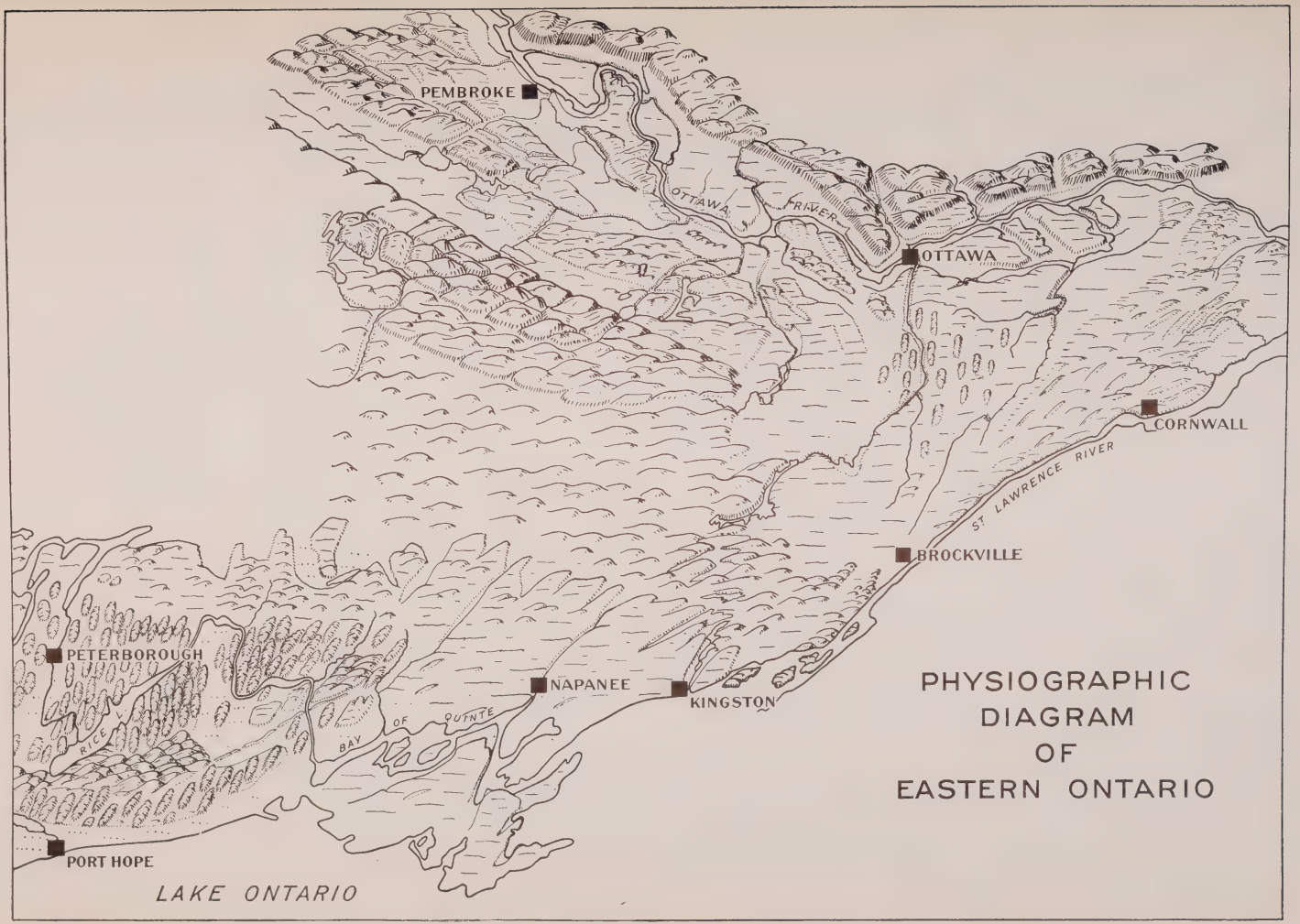
The geological background of Eastern Ontario is relatively simple. It consists of triangular facets of adjoining formations. The oldest and hardest rocks and hence the most rugged bed-rock topography are found on the Canadian Shield which here extends an attenuated limb southeastward toward the dome of the Adirondack Mountains of New York State. This exposed area of pre-Cambrian rock, known as the Frontenac axis, is flanked on both the northeast and the southwest by extensive plains underlain by paleozoic rocks, whose sedimentary strata have departed but little from their original horizontal position. Most of these rocks are limestones or dolomites but in some places shales and sandstones occur.

Although no folding has taken place in Eastern Ontario, there has been developed a rather extensive system of faults. The edge of the shield north of the Ottawa River is a fault-line scarp, so also are the margins of the Bonnechere Valley in Renfrew County. On the low plain south of Ottawa an intricate pattern of faults can be traced, some of them involving movements of hundreds of feet. For instance, near the village of Russell, the red shales of the Upper Ordovician have been brought down into juxtaposition with the Beekmantown dolomites at the base of the system—a displacement of fully sixteen hundred feet.

The ancient drainage pattern is interesting. The rock valleys tributary to the north shore of Lake Ontario all trend toward the southwest, a direction which is not normal to the St. Lawrence drainage. The Ottawa drains practically all of the basin east of the Frontenac axis, its valley is deep and the water divide is in places within a mile or so of the St. Lawrence which receives hardly any tributaries at all. There is no doubt that the Ottawa is the ancient master stream and the present St. Lawrence drainage from Lake Ontario is to be regarded as an accident.

DEVELOPMENT OF THE PRESENT SURFACE FEATURES

The Pre-Cambrian and Paleozoic rocks which underlie the region are among the oldest known. The flat rock plains of Eastern Ontario


PEMBROKE
OTTAWA RIVER
OTTAWA
CORNWALL
ST LAWRENCE RIVER
BROCKVILLE
PETERBOROUGH
NAPANEE
KINGSTON
TRENT RIVER
BAY OF QUINTE
PORT HOPE
LAKE ONTARIO
PHYSIOGRAPHIC DIAGRAM OF EASTERN ONTARIO

and the level skylines of the ridges on the Shield were developed millions of years ago. The land forms on the surface, composed of unconsolidated material, are comparatively recent. Their actual age can be measured in thousands of years.

In relatively recent times Ontario was covered by ice much as Greenland and Antarctica are to-day. Indeed, as is shown by the classical evidence at Scarborough Bluffs, Ontario was glaciated several times. Similar, but not so spectacular, exposures in Eastern Ontario also indicate that there were successive ice sheets. Of course we know very little about the earlier periods since most of their work was destroyed by the last, or Wisconsin glaciation as it is called. The general direction of movement of the ice which passed over Eastern Ontario was from the north or northeast as is shown by the scratches on the exposed rocks and by the moulding of the unconsolidated materials.

The melting of the ice left a great variety of deposits on the surface, all of them derived from the solid rock by the grinding and plucking action of the glacier. Since the ice had passed over both the Shield and the lowland the transported material, or drift, is found to consist of granites and other hard pre-Cambrian rocks mixed with limestone and shale from the Paleozoic strata. In size, the particles range from huge boulders weighing many tons, down to finely divided clay.

The most characteristic and widespread of these deposits is the *ground moraine* which was ground up beneath the ice as it advanced. The mixture of unassorted rock fragments of which it is composed is known as *boulder clay* or *till.* In many places this is known to farmers and contractors as "hard pan". There are large areas of this type with very little total relief. These we call *till plains.* Sometimes similar material is pushed up ahead of the ice into hills and ridges called *moraines;* such is the nature of the hilly belt south of Rice Lake. In addition to till, however, moraines also contain great quantities of sand and gravel deposited by melt water streams issuing from the ice.

After the ice melted, Eastern Ontario was, for a considerable time, flooded by water to a depth of hundreds of feet and in consequence the lower areas are covered by deposits of sand, silt and clay; while on the hillsides there are many old beaches of sand and gravel, as well as boulder strewn stretches from which the waves have washed away the finer materials.

The Ottawa River itself had a large part in the shaping of the Eastern Ontario landscape. While the area was flooded it carried in a great deal of material which was deposited as a huge delta in Renfrew County. When the water level dropped, the river carved a new valley in its own deposits and built a new delta in the region below Ottawa. Once again the water level retreated and the river was forced to erode away a large

part of this deposit also. There still remain wide terraces in many places that are remnants of these formations.

SOIL DEVELOPMENT

The factors of soil development in any region are, broadly speaking, three in number: the climate, the biological activity, and the parent materials. We customarily think of the first two as the active factors and the latter as passive. This discussion is chiefly centered about the nature and distribution of soil materials, but it would be well, briefly, to consider the other factors and to note as well some regional characteristics of the resulting soils.

Climate:

The climatic factor may be represented by the statistics in Table I.

TABLE 1—Climatic Statistics for Eastern Ontario[1]

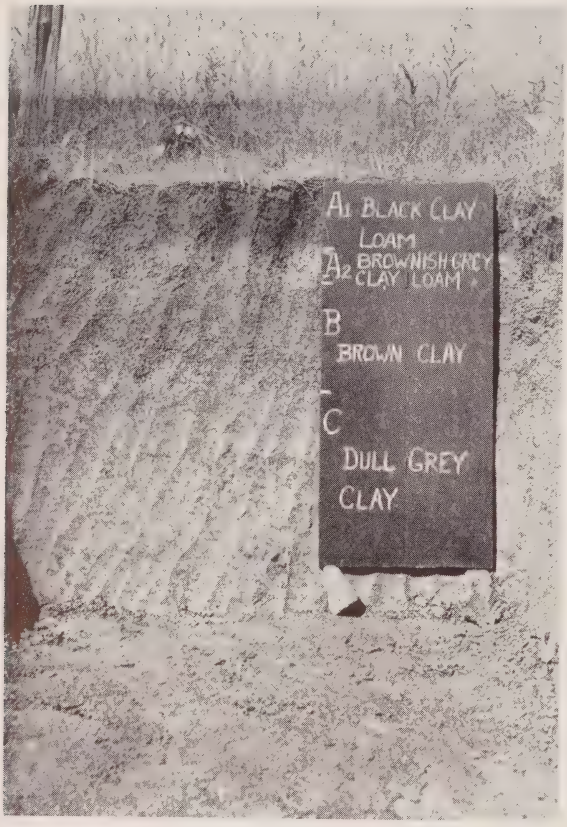
	Kingston			Ottawa			Pembroke		
	Mean Temp. °F.	Precip. Inches	Snowfall Inches	Mean Temp. °F.	Precip. Inches	Snowfall Inches	Mean Temp. °F.	Precip. Inches	Snowfall Inches
January	18	2.83	17.8	11	2.97	24.6	10	2.41	18.8
February	17	2.21	14.3	12	2.59	21.3	12	1.98	16.6
March	27	2.47	10.7	24	2.56	15.2	23	2.26	14.1
April	41	2.21	3.2	42	2.13	4.4	40	2.19	4.4
May	53	2.92	0.2	56	2.58	0.1	54	3.24	0.2
June	63	2.87	....	64	3.38	....	63	3.23	....
July	68	2.81	....	69	3.34	....	67	3.78	....
August	67	2.71	....	66	2.91	....	64	3.02	....
September	60	2.76	....	58	2.79	....	56	3.98	....
October	48	2.92	0.3	46	2.73	0.8	44	3.55	1.7
November	36	2.82	5.9	32	2.40	9.1	31	3.39	8.8
December	24	2.95	14.4	18	2.95	20.9	17	2.65	17.7
Annual	44	32.48	66.8	42	33.33	96.4	40	35.68	82.0

[1]A. J. Connor, Meteorological Tables. Canada Year Book, 1931.

There is no great variation in summer temperatures in Eastern Ontario; while in the matter of rainfall, Kingston, in common with other points on Lake Ontario, gets somewhat less than the Ottawa Valley. Kingston also has somewhat milder winter temperatures and gets less snowfall.

Vegetation:

The natural vegetation is of particular interest in Eastern Ontario because, here, more than in other parts of agricultural Ontario, there are definite soil differences due to variations in the type of forest. For instance, the grey clay soils of Renfrew County were developed under a



The soil profile is a section through the soil body from the surface to the parent material. Its appearance reflects the influence of the climate and vegetation of the region. The A1 horizon is dark because of the incorporation of organic matter, the A2 is light colored because of leaching while the B is brown in colour and somewhat heavy in texture from the deposition of material removed from the upper horizons.

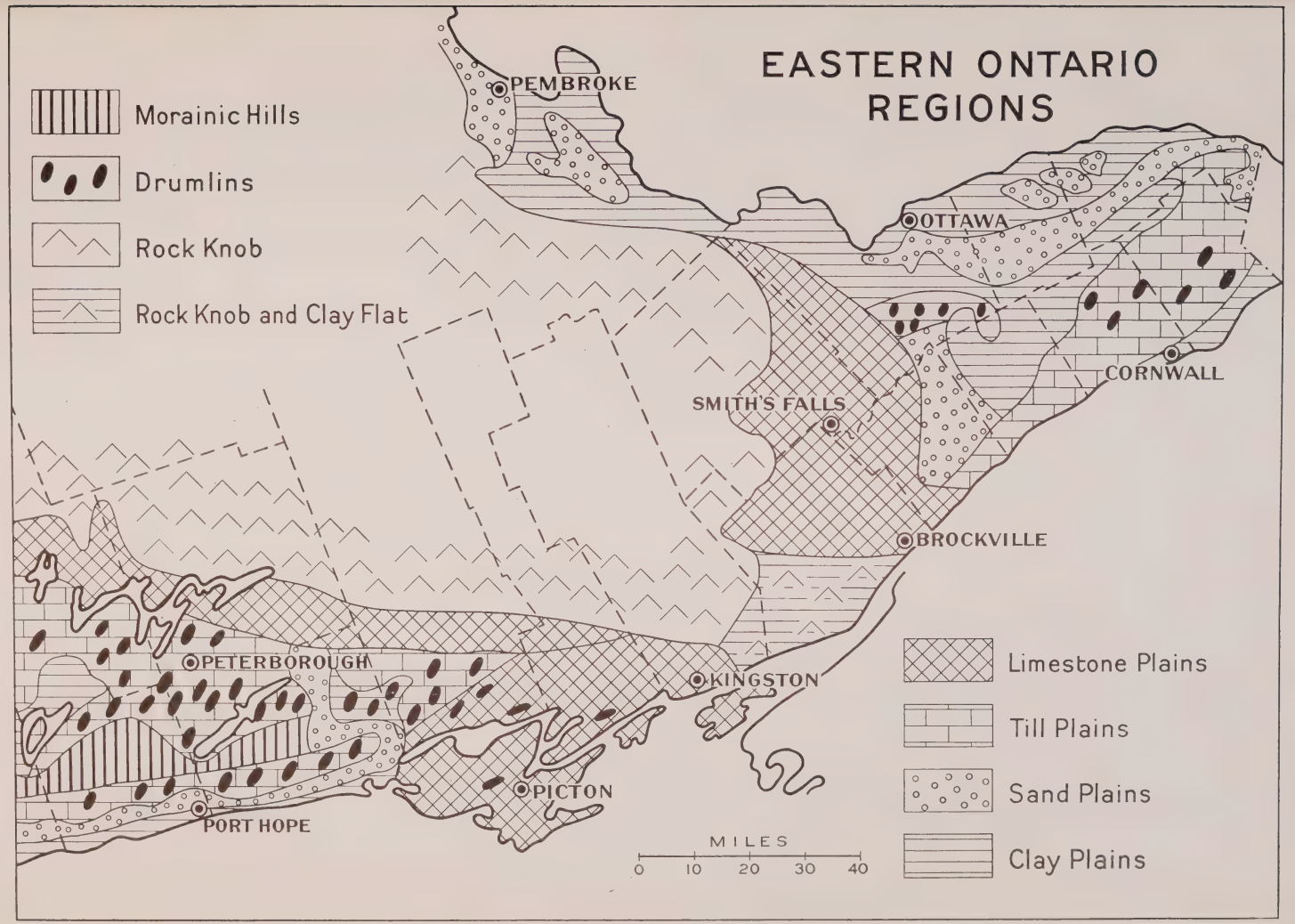
mixed forest which contained a large proportion of pine and spruce; the dark clay soils of the Carp Valley and of Dundas County had an original forest of elm, ash and soft maples. At the present time there is a conspicuous difference in roadside vegetation; in Renfrew, silver cinque-foil abounds while the darker soil has a thick blue grass sod.

Originally some of the best pine stands in the country were located on the sandy soils of the Ottawa Valley. Pines were also found on the hilly lands between Rice Lake and Lake Ontario. These forests have long since been cut off and the land is now barren; numerous "blow-outs" prove the error of deforesting such soil, if proof be needed.

The shallow soils over the hard rocky knobs of the Shield bear a mixture of evergreens and hardwoods. White and red pine, sugar maple, beech, hemlock, balsam fir, basswood, red oak and birches are typical.

Forests of sugar maple and beech are still to be found on the rolling, stony lands of Glengarry, and while white cedar thrives on the associated wet soils, white and red cedars mingle on the shallow lands along with a roadside flora of stonecrop, blueweed and mullein.

Two adaptations, especially, should be borne in mind in the formulation of all conservation policies; first, the suitability of the sandy lands for the growth of pines, white pine on the better sandy loams, red pine


EASTERN ONTARIO
REGIONS
Morainic Hills
Drumlins
Rock Knob
Rock Knob and Clay Flat
PEMBROKE
OTTAWA
CORNWALL
SMITH'S FALLS
BROCKVILLE
PETERBOROUGH
KINGSTON
PICTON
PORT HOPE
MILES
0 10 20 30 40
Limestone Plains
Till Plains
Sand Plains
Clay Plains

on the somewhat coarser sands, and jack pine on the coarsest and driest of all; second, the adaptability of the sugar maple on all the stony till plains and even on many of the shallow lands of the limestone plains and on the Shield. Eastern Ontario is the centre of the maple sugar production of this province, an industry which could be greatly increased.

Soils:

The humid climate and forest vegetation lead to a type of soil formation called *podzolization;*[1] those soils in which the process is complete are known as *podzols* (from the Russian, meaning *ashy soil*); while all other soils influenced by it are known as podzolic soils. In this process the acids which result from the decay of the forest litter are dissolved by the rainwater and leached through the soil, thus removing the lime and other bases and leaving it more or less acid. The *profile*, or the face of an exposure, in such a soil, exhibits three distinct horizontal bands or *horizons* as they are called by the soils man: A_1, a dark band containing organic matter; A_2, a light coloured horizon which has been leached; B, a brown horizon in which iron, clay and other materials have accumulated; the unaltered parent material below is termed the C horizon but is not actually a part of the *soil.*

There are many different types of soil to be found even within small areas in Eastern Ontario. This is easily seen in the soils of Carleton County, the only one in Eastern Ontario for which a report has yet been published.[2] The soils of the Shield are mainly Brown Podzolic,[3] while those of the plains belong normally to the Grey-Brown Forest soils like those in Western Ontario. We are dealing with a tension zone in which numerous influences are at work. The sand plains with their pine vegetation have developed highly leached podzols with a low reserve of fertility. The Brown Podzolic soils occur on the richer loamy uplands of the Shield where there is a fairly high proportion of hardwoods. The leached horizon is thin, or often absent.

In much of Eastern Ontario, however, the soils are not normal. Great areas do not have free drainage and here intrazonal types occur in which the profiles are immature or underdeveloped. Most of the clay and silt plains have such soils. Then, too, there are large areas where the soil material over the rock is not deep enough to develop a complete profile. Such soils are very wet at some seasons of the year, and much too dry at others.

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[1] C. E. Kellogg. The Soils that Support Us. The Macmillan Company, New York. 1941.

[2] G. A. Hills, N. R. Richards, and F. F. Morwick. Soil Survey of Carleton County. Ontario Soil Survey Report No. 7. Toronto. 1944.

[3] G. A. Hills. Pedology, The Dirt Science, and Agricultural Settlement in Ontario. Canadian Geographical Journal: Volume XXIX. 106-127. 1944.

The shallowness of soils on the limestone plains is emphasized by this view of a drainage ditch near Smith's Falls. The soil is less than a foot in depth and most of the excavation is in solid rock. A large part of this shallow land is kept in permanent pasture.

REGIONAL LAND TYPES

It is quite possible to divide Eastern Ontario into regions which have certain characteristic associations of soils, land forms and geological deposits. The Canadian Shield can be accepted as a region, and for our purpose no attempt will be made to subdivide it. In the adjacent plains, however, a number of land type areas have been delimited as shown in Figure 2, and they will be discussed in the following paragraphs.

Rock Knob Uplands:

The surface of the Canadian Shield is characterized by numerous rocky knobs or hills. Bare rock is, actually, only a minor element in the landscape, but much of the region has only a shallow covering of stony soil and drift. In spite of the valiant efforts of the pioneers, agricultural occupance of the land is extremely patchy in its distribution and is, as a rule, unsuccessful. Farming is only a part-time occupation for many of the inhabitants, whose chief resource has always been the forest. The problem of this region is one of ensuring the permanency of this resource. It is discussed in detail elsewhere in these proceedings.[1]

[1]G. M. Dallyn. Forest Regions of Southern Ontario.

In certain areas, however, notably in Leeds, Frontenac and parts of Renfrew, the rocks of the Shield are deeply buried beneath thick deposits of clay so that only the highest hills are exposed. There are, also, within the area of limestone rocks certain old hard-rock hills now exposed. The ridge along the north side of the Carp Valley is the most extensive of these. Others, however, are found near Shannonville in Hastings County and in Grenville County. Rigaud Mountain, just over the border in the Province of Quebec, is another notable outlier of the Shield.

Limestone Plains:

On both flanks of the Frontenac axis there are extensive tracts of shallow soils overlying flat limestone rock. The Counties of Carleton, Lanark, Grenville, Leeds, Frontenac, Lennox and Addington, Hastings and Prince Edward together contain at least 2,500 square miles of limestone plains. The western area has previously been designated the Napanee Plain,[1] the town of Smith's Falls is the approximate geographic centre of the eastern plain.

While the outstanding characteristic of these areas is the shallowness of their soils, there are many variations to be observed. The depth to rock may vary from two or three feet to practically nothing at all. Sometimes the soil material is waterlaid clay or silt while elsewhere it consists of very stony boulder clay. The northern portion of the Napanee Plain is partially covered with low mounds of morainic material, often of a fair depth but extremely stony. The lower areas along the Bay of Quinte sometimes have a fair depth of clay. In Prince Edward County there are rather large areas where the upper layers of the Trenton limestone are interbedded with shale and readily break up into pieces not unlike coarse roadstone. Plant roots are able to penetrate rather deeply into this "clay-gravel", as it is known locally. The Smith's Falls region is underlain by the Beekmantown formation, a sandy dolomite which is much harder than the Trenton limestone, and the soils are correspondingly shallower. Conspicuous features, found here, are the marine beaches or bars which appear as crooked ridges of gravel or "shingle" on prominences, or as parallel strands in stepped fashion on the long slopes. Notable examples may be seen near Stittsville and Panmure. On some farms these gravelly areas constitute the only soil of sufficient depth to support cultivated crops.

The chief problem in this area is drought, since the shallow soil cannot hold enough moisture to support a crop through the dry periods which are bound to occur every few years. In consequence, hundreds of farms have been abandoned to pasture and there is a high percentage of woodland and waste. The areas were once entirely forested and it is

[1]D. F. Putnam and L. J. Chapman. 1936. op. cit.

This view in Otonabee Township is representative of closely drumlinized areas. Parts of at least ten distinct drumlins can be seen in the picture. This hilliness of the land presents some problems to farmers. Only a small porportion of any farm is level land.

probable that a great deal of the forest should be replaced, or at least encouraged to replace itself.

Till Plains:

Ground moraine or till plain is probably the most extensive type of surface formation in Southern Ontario, accounting for at least one-third of the area. In the region mapped as Eastern Ontario the proportion is somewhat less but the area involved must be fully as large as that of the limestone plains. The topography of the till plains varies somewhat. In many places it is flat to gently undulating with no sign of any definite arrangement on its inconspicuous surface features. In other places the surface is rolling to hilly with a definite pattern to the landscape. The total relief, however, is seldom more than 200 feet and usually less than 100 feet.

The regularly arranged oval hills are known as *drumlins*, a word of Irish origin, since hills of this type were first observed and studied in Ireland. Similar hills are found in nearly all glaciated countries but they are particularly abundant in Nova Scotia, Massachusetts, New York,

Ontario and Wisconsin. In our map area they are clustered most thickly in the vicinity of Peterborough and Rice Lake where they average between four and five to the square mile. Farther east they are more scattered in their distribution, but groups of them occur in North Gower and Osgood Townships and in Glengarry County.

A typical drumlin is about a mile in length and a third of a mile in width, with a height of fifty to one hundred feet. Viewed from the side it is usually seen that the highest point of the crest is toward one end of the hill, and that end, often called the "nose", has, naturally, a more abrupt slope. Within any group of drumlins it is found that the noses all point in the same direction. A group of drumlins resembles a school of huge whales basking on the surface and are often termed "whalebacks". This effect is heightened when, as in Rice Lake, they are completely surrounded by water.

The material of which they are composed is till, the same mixture of clay and stones which is found in the smoother areas of the till plains, and it is evident that these hills were also formed beneath the ice sheet. The noses of the drumlins all point toward the direction from which the ice came and it would seem as though the drumlins were built by a "plastering on" process, much as a sculptor models a clay figure.

Although the till plains and drumlin areas usually have well developed and rather durable soils, they are not without their problems. Drainage is in most cases good, in fact sometimes excessive on the drumlins, but there are areas where the till is shallow or the surface is rather flat, that are poorly drained. In such cases it is difficult to install artificial drains because of the stoniness of the soil material.

Drumlinized topography exerts considerable influence upon the type of land utilization. It is usual to find a much greater percentage of wasteland there, than upon the smoother portions of the till plain. The much greater proportion of sloping land is also conducive to soil erosion under excessive and unwise cultivation. In some townships the difficulties of the farmer were greatly accentuated by the orientation of the original survey lines which often cross the hills at very inconvenient angles. The roads, also, give one the sensations of the roller-coaster. However, drumlinized country is not necessarily second-rate agricultural land. The soils are usually high in lime and of a desirable loamy texture, provided the stones be removed. Steeper slopes should be, and often are, left in grass or trees; while even the gentler slopes should not be plowed directly up and down the hill.

The stoniness of boulder clay is always intensified where waves were able to work upon the shores of the ancient bodies of water. Belts of extremely stony land mark the shorelines of old Lake Iroquois near Grafton, the Murray Hills and Campbellford, to mention a few locations;

while farther east, boulder beaches of the Champlain Sea are found on the crests of numerous drumlins.

Morainic Hills:

Rough land is found in the morainic hills south of Rice Lake. This is the eastward continuation of hilly belt which runs through the whole length of central Ontario. Parts of it are more than 1,000 feet above sea level and the local relief is sometimes serveral hundred feet. Slopes are steep and often very irregular. Some of the hills and ridges are composed of till but many are of sand and gravel. Drainage is usually effected by short steep ravines leading to the plains below, but there are areas of kettles or basins from which there is no exterior surface drainage.

The original forest was largely of pines and oaks with inclusions of maples and other hardwoods. In spite of the rough topography and poor sandy soils, the forest was nearly all removed and the land was put to agricultural use. Soil deterioration and erosion followed rapidly and much of the land is now abandoned. Some attempts at reforestation have been made, particularly in the Durham and Northumberland County forests, but much more land still needs attention. The conditions on a sample area are described in the Ganaraska report.[1]

East of the Frontenac axis, there are no rough morainic lands of this type.

Clay Plains:

Clay plains are fairly extensive in Eastern Ontario, covering at least 2,000 square miles. There are several different types of clay: (a) the drab clays of the Nation Valley in Dundas and Stormont Counties, which usually contain some lime carbonate, and the similar though slightly more silty clays of the Carp Valley; (b) the impervious waxy pink and grey clays of Russell and Prescott Counties which, as a rule, do not contain much lime; (b) the grey clays and silty clays of Renfrew County, which also contain little lime; (d) the drab clays of Leeds and Frontenac Counties; and (e) the limy clays found in various portions of the basin of old Lake Iroquois in the western part of our map area.

Some of the deposits are very deep; well-drillers have reported 180 feet of clay at Wendover, 186 feet at Ramsayville, and 220 feet at Breckenridge. In addition to the deep clays there are many small patches of shallow clay occurring in depressions of the limestone plains and in the undulating till plains, as for instance in Glengarry County. In the area north of Rice Lake, and also near Stirling, the lowlands between the drumlins are floored with clay. A similar landscape of drumlins and clay flats exists in North Gower. In parts of Leeds County

[1]A. H. Richardson. A Report on the Ganaraska Watershed. Published jointly by the Dominion and Ontario Governments. Toronto. 1944.

A dairy farm on the clay plains. The better drained parts of these plains are productive farm lands. Soil erosion is not troublesome even with a large area of cultivated crop.

the landscape consists of rock knobs and clay flats in fairly definite patterns.

Many of the clay plain areas are so flat that drainage is imperfect and mature soils have not developed. There are large areas of bog as, for instance, in Winchester and Caledonia Townships. Shallow areas of peat are often burned off, but the tough whitish clay which lies beneath is difficult to work.

Where drainage is more efficient, particularly near some of the streams which have cut shallow valleys into the plains, more mature soil profiles may be seen. In Renfrew County the surface soils may be quite highly leached, grey in colour and somewhat acid. Greyish soils are also seen in Russell County. On the other hand, the surface soils of the Carp Valley and of Dundas County are dark in colour.

Fine Sand and Silt Plains:

In many parts of Eastern Ontario, there occur scattered areas of fine sand or silt which cannot be shown on a small scale map. However, in the area drained by the Castor River in Carleton and Russell Counties and extending into Prescott County there is a belt in which lighter textured materials overlie the clay. A similar type is found in the southern

part of Glengarry County. Together they cover about 225 square miles. Silts and fine sands are also found in the counties west of Kingston although not in such large well-defined tracts.

Lack of good drainage often characterizes these areas and soil profiles are not fully developed. Where drainage is provided, however, they become productive soils. The flax-growing industry of Lancaster Township is quite largely found on these lands.

Sand Plains:

Under this heading are included all surfaces composed of deep coarse sands. Only the larger areas can be shown on a small scale map, but they amount to at least 800 square miles. The most extensive areas are those of the old deltas of the Ottawa River, lying in Renfrew, Carleton, Russell and Prescott Counties. The material is largely of pre-Cambrian origin and contains very little lime. The sands of Grenville and Dundas, on the other hand, usually contain free lime carbonate, as do all those lying west of the Frontenac axis.

Drainage conditions in the sands vary. In Russell and Prescott, where they form a broad terrace adjacent to the Nation River valley, drainage tends to be excessive. At some distance from the main stream valleys, however, and particularly where underlain by clay at shallow depths, the water table is fairly close to the surface. Such a condition occurs in Grenville and Dundas to a considerable extent.

The soils of the sand plains are usually leached and infertile. Although considerable areas were cleared and farmed there has been much abandonment and erosion is very evident in some localities. It was a mistake to have opened these lands for settlement when the pine was removed, and, as fast as possible, they should be reforested. The Larose Forest is an excellent example of the type of work that should be carried out over a very much larger area.

There is, of course, considerable variation in these sandy soils; not all of them are equally useless. Near Pendleton, for instance, there are a number of hop-gardens. In similar sand plains at the extreme westerly margin of our map area, tobacco is being grown in the Ganaraska valley. These are specialties, however, and their presence does not alter the fact that the soils are poorly adapted to general farming programmes of production.

THE VALUE OF THE REGIONAL APPROACH

An understanding of the characteristics of regions and subregions is basic to the application of conservation principles. In the United States, the Soil Conservation Service is fully organized upon a regional basis; having due regard for the climatic, vegetational, pedological and

agricultural factors in each area. It is true that water finds its way to the sea through rivers and the engineering control of run-off must be planned upon the basis of drainage basins or catchment areas. The river, however, usually has no other regional significance; in fact, rivers cross the regional boundaries indiscriminately. This is particularly true of most streams in Eastern Ontario; they have their sources among the rocky hills of the Canadian Shield and their lower courses cross the lowland plains for considerable distances before emptying into the Ottawa or St. Lawrence. The conservational requirements for different parts of the drainage basins will vary accordingly.

Even the South Nation River, whose course lies entirely within the plain, has, within its million acres of catchment area, very distinct regional contrasts. Its headwaters gather on the limestone plains of Leeds and Grenville Counties. Here there is little impediment in the way of run-off because the shallow soils have little water-holding capacity once the covering of forest litter is removed. Then for many miles it flows through a sandy region on the borders of Grenville and Dundas Counties before entering the clay plain which we think of as the Nation Valley. Land use must be planned differently in all three areas under any sane conservation programme.

The Nation River has more contrasts downstream. After wandering for more than thirty miles in a northeasterly direction over a flat clay plain, it turns sharply westward below Casselman, and then northeast again to cut a canyon fifty feet deep through a sand plain for ten miles before emerging upon a second clay plain to flow due east for ten miles to the vicinity of Lalonde. With another wide swing it turns to flow northwestward through a rather restricted valley at Plantagenet to the Ottawa. In the lower fifty miles of its course, through canyon and wide plain alike, its gradient is never more than two feet per mile, except where it crosses the rock sills at Casselman and Jessop's Falls. Various conditions are also found along the tributaries, not to speak of the Mer Bleu, the Alfred and the Winchester peat bogs which also lie in the drainage basin.

It is not my intention to describe the problems of the Nation Valley, they will be ably presented this afternoon by Mr. Larose;[1] I merely wish to make the point that the problems must be viewed in their regional setting. The conditions do not stop at the watershed; in fact, in many parts of Ontario, such boundaries are rather hard to define.

[1]Ferdinand Larose. "The South Nation River and Its Environs."

9

DR. R. C. WALLACE

(Luncheon Queen's University, February 3rd)

It is a great pleasure for us at Queen's, the Trustees and Members of Staff, to have you here with us to-day on matters of such vital importance as has been discussed during yesterday and to-day and will be this afternoon.

It has always seemed to me a very simple matter, this matter that we are discussing. I was brought up in a farming community, and it was a farming community where the farms happily passed from farmer to son, through the generations, and it was a settled community or so settled it was not a discussed principle, that the farm should be handed by the father to the son in as good heart (that was the word that was used) as he had received it from his father. It was not debated—that was accepted as a general principle and acted upon.

I remember very well, going back to my boyhood days, a neighbouring farmer who looked, as some farmers do, very pessimistically on everything, even in good years. You know some farmers of that type.

Well, on this particular occasion a field of bottom land through which a little stream we called a burn flowed, had been extremely productive in a crop of oats, so productive that it had, as we said in those days, bedded—we call it "lodged" now—and when it was cut and stooked, the stooks were so close together you could hardly see any space between them at all.

On this occasion I remember my father saying to his neighbour, "Well, Ned, you had a very good crop on this field this year, after all, didn't you?"

And Ned, smoking his clay pipe, with the black twist tobacco, the little tin cap on the top of the pipe that some of you may remember, and the pipe turned upside down, which is the natural way to smoke tobacco after all, looked at him and said, "Well, it was very hard on the land."

And behind that was something really true, and he realized it. He didn't want to admit that it was a good crop, but at the same time he found a reason for some question of concern in that it was drawing from the land more than he felt it was advisable that it should draw.

And what one thinks about an individual farm is what one is thinking to-day in this conference about all our resources, generally, not only the land, but the forest, the water power, the underlying water and the wild life that we must leave "in as good heart" to those who come after us as we received it from those who handed it to us. That is the whole principle of this discussion, a very simple one indeed, to-day.

It is not so simple in its application. It is very simple in the principle, and we will all accept it immediately without any question. When one comes to the application one realizes very soon, knowing human nature, that it is not enough to say that this is a good thing to do. We are so constituted as human beings that we may accept a principle as valid in general. Yet when it comes to a personal application we have to see an advantage to us personally in it.

In other words, we look at matters relatively selfishly. I am not cynical about this. I am simply stating a definite fact in human nature, and if we are wise we will always keep those facts clearly in mind.

In other words, unless a farmer or a forester or a man concerned with wild life and its production, realizes that what he is going to do in conservation is going to help him personally, no government will be able to put conservation measures across. The main purpose, after all, in the education of conferences such as these I take it, is to show in some way or other by demonstration, that the individual farmer or the individual man who is concerned with fur farming, or whatever it may be, will be benefitted personally by the things that he is going to do. And one must be clear that the arguments are such that they do appeal to the personal individual concerned.

I remember in the days when I had some administrative responsibility in a northern territory in Manitoba, where the Indians were part of the population, and the main part, a well-meaning citizen, a business man of the community in which I lived, up in the Pas, in Northern Manitoba, who had become rather irritated with an Indian who was doing and simply would do, no work at all, said to him, "Well, Solomon," (many of them are called by Biblical names, as you know, in that territory), "Well, Solomon, you should go to work."

"Why?" Solomon said.

"Well, to make money."

"Why?"

"Well, so that when you are old you won't need to worry."

"Ha!" Solomon said, "Don't worry now."

The argument didn't appeal. It didn't go home.

So it is necessary, first of all, it seems to me, to make sure that the individual persuades himself through the facts that he individually will be benefitted. And, secondly, to make him realize by demonstration and otherwise, as Dr. Graham showed so clearly last evening, that in some cases it is necessary for him to co-operate with others in order to be benefitted personally. In other words, to realize there must be enterprises to be carried on by a group in a region, or whatever it may be, together.

And, thirdly, and this Dr. Graham also showed very clearly, and it is something I realized after two weeks with the Tennessee Valley Authorities two years ago, it is supremely a part of that group feeling that they are doing the job themselves and are managing themselves and are not controlled by government agencies.

In other words, that it becomes a definitely democratic group, managing its own concern, and being assisted only technically by technical officers and government.

Now, it is very easy for technical officers and government to control, it is not nearly so easy to let people govern themselves. But the essence of democratic government rests in the group and the community governing itself, and that system which was shown last evening as spreading so widely across the United States is something to which we should give a great deal of thought, because these are groups which are governing themselves, democratically. The only sound democratic government is government that springs from the grass roots in the people who are governing themselves.

These are some points then it seems to me that we have learned during this conference, that I have learned, and they are points that are beginning now to be put into effect through the Government that has been wise enough to appoint this Department of Planning and Development.

I look back, sitting at this table, to the days when the Association, which is represented at the head table by our Chairman and by the members, in those days when it wasn't so easy to talk about Conservation, established the Guelph Conference. That Guelph Conference had functions of many kinds. One, in creating a relationship with a body representing the Federal Government at the time, in order that there could be developed between Ontario and the Government of Canada a survey of an area which would be taken as a type area. Fortunately that survey, established through the Provincial and Federal Governments was put in the hands of Mr. Richardson, and the result we all know, who have had the Ganaraska Survey Report. It is a report greatly significant for the future.

I think also as well, as I see Mr. Thomas sitting at the head table, of the exceedingly valuable work that the Canadian Legion through its officers and men did in conservation in those days and is still doing.

You know, we need all this political assistance. One of the strongest political bodies in the Dominion of Canada is the Canadian Legion. When they speak and speak with wisdom and authority to any Government, Federal or Provincial, that Government sits up and takes notice. They made the Government sit up and take notice in the matter of Conservation.

The result of it is we have to-day, fortunately, a Government in Ontario which has appointed a Department which has officers such as the Minister, and the Director, Dr. Langford, and assistants such as Mr. Richardson, who is here, not looking at the matter politically, in the sense in which we use the word, but looking at it in the real sense of the word, *politically*, that is in the real interest of public affairs.

I have not yet heard Mr. Porter say anything that could be interpreted as political in the ordinary sense of the word. His words are political in the best sense, that it is in the best interests of our country and of Canada.

Those of us who are living in this Province and who are watching affairs, are very happy indeed in this action of the Government and the way they are coming to the people in conferences such as this and trying to make the action spring from the people, rather than from themselves. They are acting as guiding and directing technical advice in the whole matter.

There is one thing more and I am through. It is very clear to all of us in these discussions that the need is very great for scientific technical advice. On every hand we hear experts say, "We have not yet the facts. We do not know." That is a responsibility that comes back on the universities and the universities, we hope, will be remembered by governments in this need, in that it costs money to train men and women in this public service, and requires funds which sometimes universities find rather hard to get.

I have not the slightest doubt in my own mind that the future of Canada and its prosperity in those years of difficulty that follow the war, will depend more on the getting of sound and able technical scientific research to carry on the work on our resources than on any other single thing. We have not enough of it. It takes time to train men. The universities stand ready to do it and are already doing it to the best of their ability.

When we look forward to the days when we will have to compete on exports from Canada with the world on a much larger scale than ever

before if we are to have full employment, we know very well that the factor of labour cost will not likely go down much, and the only other way in which we can meet the situation is by scientific, technical knowledge in reducing process cost of the manufactured articles that Canada will send out into the world. We are dependent so greatly to-day on scientific knowledge, and we realize it. We have seen Russia do what she had done so amazingly as she has done it in the last ten or fifteen years, in the last two or three years, and in the last two or three days, in large measure because of knowing how to use scientific knowledge, and trained men, trained technically and scientifically in their country.

Mr. President, it has been a great pleasure at Queen's to sit in with you. It has been a great pleasure to be your host at this meeting. There comes to my mind something I always think about when it is time to close.

It was a political meeting in Saskatchewan in a little country barn, filled to the door. The young man was speaking as the political candidate, and he had a young Chairman sitting to his left. An old farmer, gray haired, gray bearded, came in the front door. He saw no single chair vacant at all, except one. The Chairman had been called out for the time being and the Chairman's chair was vacant. He went up the aisle, to the back of the speaker and sat down on the chair.

The speaker, later on, turned to the Chairman to make some remark. He then turned back to the audience and said, "Ladies and Gentlemen, I must apologize. I didn't realize I had spoken so long. The Chairman has grown a beard and has become gray haired."

And he sat down—and won the election.

Well, Ladies and Gentlemen, I have no election to win. That is, only one—that you elect as soon as you can again to come to Queen's to be our guests here at a conference sponsored by the Department of Planning and Development. And I, too, shall sit down.

MR. H. SIRRET

In order to further the purpose of what I have to say I would like to build up a little background. Shortly after the beginning of the war there was set up by the Dominion Government a Committee on Reconstruction, of which Dr. Cyril James, of McGill University, was the Chairman, and which has been known as the James Committee. One of that Committee was our host, Dr. Wallace. He was also appointed Chairman of one of the Sub-Committees, namely the Sub-Committee on the Conservation of Natural Resources.

Dr. Wallace in his address made reference to the Guelph Conference. I would just ask you to bear with me a moment while I enlarge slightly

on Dr. Wallace's reference. This Guelph Conference was a coming together of the representatives of several organizations, and among them was the Ontario Conservation and Reforestation Association, usually referred to as the O.C.R.A.

This organization is so broad that it includes every one in the Province of Ontario, regardless of whether or not they are conscious of it. There is no initiation fee, no membership fee, and whether you are conscious of it or not you are either an active or a passive member, so when I say "we" it means all of us.

We, in seeking to further our work, approached the Dominion Government through the James Committee, and the sub-committee of which Dr. Wallace was Chairman, with the idea of holding certain discussions on Conservation. These discussions led to the setting up of the organization which resulted in a survey of the Ganaraska Watershed, which Survey has already been referred to.

While the two Counties of Northumberland and Durham are very close to that watershed, and though we realize that area was selected merely because it offered an opportunity for a certain type of work and perhaps offered some experience in making a certain type of investigation, nevertheless we felt we were very much favoured in securing that survey for that area.

As a result of that survey a report has been prepared by our friend, Mr. A. H. Richardson. I hope each and every one of you have received a copy of that report and I assure you if you have not you should secure one and read it. It is entertaining and instructive and a worth-while addition to anybodys' library. Because of this and also because we feel that we owe something to Dr. Wallace, as the head of the Sub-Committee on Conservation, and because of his general interest in what we are trying to do, and the exceedingly pleasant, approachable manner in which he has helped us, and for his hospitality in having this conference here at Queen's, as a token, Dr. Wallace, of this appreciation, we have had one of these reports specially bound and inscribed.

I therefore take great pleasure, Dr. Wallace, in presenting you with this copy of the Ganaraska Report, hoping that it will be a memento of this occasion and a reminder of our appreciation for what you have done for us.

DR. R. C. WALLACE

Needless to say I have a copy of this report but not so nicely bound and certainly not so nicely inscribed. I have also read this report carefully, but from now on, Sir, it will be my bible in the whole literature of conservation.

10

THE SOUTH NATION AND ITS ENVIRONS

Ferdinand Larose
Agricultural Representative, Plantagenet, Ontario

IN dealing with this topic allotted to me, I should like to say a word on the Nation River itself, what I mean by Conservation, its need, what has been done in the past, and, in my estimation, what should be done in the future.

1. THE SOUTH NATION RIVER

[a] Its Name:

There are two streams bearing the name of "Nation": the North Nation River and the South Nation River. The word "Nation" comes from the name of a small Indian tribe of the Algonquin blood, living on the shores of those two rivers, and called, because of its size, "La Petite Nation"—"The Little Nation", by the first French explorers.

The North Nation River, entirely located in the Province of Quebec, empties into the Ottawa River, at a point east of Plaisance, directly opposite the mouth of the South Nation River.

It drains land north of the Ottawa River, including the Papineau Estate, called "La Seigneurie de la Petite Nation"—"The Seigniory of the Little Nation", which is now owned and operated by the Seigniory Club Community Association Ltd., Montebello, P.Q.

[b] Its Drainage System:

The South Nation River drains land from eight of the eleven Counties comprising Eastern Ontario, or if you wish, Zone No. 5, of the Ontario Conservation and Reforestation Association. Its source is located four miles north of Brockville, in Leeds County. It runs through Grenville County, crossing Highway No. 16 at Spencerville, enters Dundas County at Heckston, crossing Highway No. 31 at Cass Bridge, runs into Stormont, between Chesterville and Crysler, then into Russell near St. Albert, going through Casselman, then into Prescott County at Lemieux. From there it runs north to Pendleton, then east to Riceville, taking a bend at Fournier, then north to Plantagenet Springs, crosses the C.P.R. short line, and Plantagenet village proper, and running north-west to Jessop Falls, it empties into the Ottawa River near Wendover. The length of the river, as the crow flies, is 75 miles, or, if we are to consider its main bends and meanders, approximately 100 miles, with a slope of 245 feet. The widest point of the drainage system is 35 miles.

By T. C. Lovell.

South Nation River, two miles east of Roebuck.

The area of the watershed nears the *million-acre* mark, or approximately, 915,600 acres, distributed among the eight Eastern Counties as follows:

78% of Dundas County
77% of Russell County
52% of Prescott County
43% of Grenville County
41% of Stormont County
19% of Carleton County
9% of Glengarry County
2% of Leeds County

Total — 8 Counties

These figures and others on Reforestation have been supplied by


PROVINCE OF QUEBEC
OTTAWA RIVER
ALFRED
PLANTAGENET
NORTH PLANTAGENET
CLARENCE
CUMBERLAND
GLOUCESTER
RUSSELL
CAMBRIDGE
CASSELMAN
ROXBOROUGH
OSGOODE
FINCH
WINCHESTER
MOUNTAIN
OSNABRUCK
WILLIAMSBURGH
MATILDA
EDWARDSBURGH
AUGUSTA
CARLETON
RUSSELL
PRESCOTT
GLENGARRY
DUNDAS
STORMONT
GRENVILLE
LEEDS
LANARK
OXFORD
KENYON
SOUTH NATION RIVER
RIDEAU CANAL
ST LAWRENCE RIVER
UNITED STATES
OTTAWA
Navan
Carlsbad Spgs.
Leitrim
Piperville
Edwards
Gloucester
Johnson Cors.
N. Osgoode
Waller
Metcalfe
Herbert Cors
Marvelville
Marionville
W. Osgoode
Vernon
Dalmeny
Reid Mills
Winchester
Hallville
Inkerman Sta.
Inkerman
Mountain
S. Gower
S. Mountain
Heckston
Millar Cors.
Oxford Sta.
Hyndman
New Ross
Glen Stewart
Ventnor
Groveton Sta.
Pittston
Spencerville
Roebuck
Mainsville
Crystal Rock
Domville Sta.
Charleville
Domville
Glenmore
Maynard
Lordmills
Algonquin
S. Augusta
BROCKVILLE
Sarsfield
Leonard
Beamsville
Vars
Limoges
Embrun
Russell
Kenmore
Felton
Forget
Cannamore
Morewood
Ormond
Melvin
Chesterville
Cass Bridge
Van Camp
Dunbar
Winchester Spgs.
Elma
Hubert
Toyehill
Bouckhill
Williamsburg
Pleasant Valley
Brinston
Dundela
Dixons Cors.
Hainsville
Rowena
Irena
Brouseville
St Paschal Baylon
Curran
Westminster
Pendleton
Bourget
Ettyville
Hammond
Grant
Gagnon
Benoit
Brisson
Pana
Castor R.
Mid. Castor
North Castor R.
South Castor
East Castor
Lt. Castor
Butternut Cr.
Moose Cr.
Scotch River
Lemieux
Rose Cor.
Tayside
Mayerville
St Albert
St Albert Sta.
Cryslers
Glenpayne
Berwick
Finch
Goldfield
Newington
Grantley
Avonmore
Moose Creek
Warina
Maxville
Dunvegan
St Isidore de Prescott
Skye
Fournier
Riceville
Bradley
Ck. South
Lalonde
Routhier
St Bernadin
St Amour
Alfred Sta.
Plantagenet
Horse Cr.
Poxton Cr.
Sandringham
St Elmo
Casselman
Rideau Canal
C.P.R.
C.N.R.
N.Y.C.
DEPARTMENT OF PLANNING AND DEVELOPMENT
ONTARIO
HON. DANA PORTER, K.C. Minister
A.H. RICHARDSON, Chief Conservation Engineer
MAP
SHOWING THE
SOUTH NATION RIVER
WATERSHED
1946
Scale
0 5 10 15 20 25
Reference
Watershed Boundary
County Boundary
Township Boundary
Railways & Stations

Mr. A. B. Wheatley, Forester, Zone No. 5, to whom I am grateful for this service.

[c] Its Soils:

The South Nation River drains some of the best agricultural land in Eastern Ontario. The topography is fairly level and the drainage is a problem. The lands on the lower level are mostly composed of clay, clay loams and silt, with muck and peat bogs in spots. The largest area of muck land is the Alfred Peat Bog, which has been operated for peat fuel for nearly half a century. The high lands are in great part formed of sand, with occasional gravel and rocky hills.

[d] Its Inhabitants:

As to the inhabitants of the Nation River Valley, they were originally English-speaking settlers of the military type, mostly Empire Loyalists. Others came directly from the Old Country, this being the case with the Scots of Glengarry. Afterwards, the surplus of the population of the Province of Quebec found its way into Eastern Ontario, particularly in Glengarry, Stormont, Prescott, Russell and Carleton. To-day, the population of Prescott and Russell is 80% of French extraction, Glengarry, 50%, Stormont, 45%, with 42% in Gloucester Township, in Carleton County, and an odd sprinkling here and there—Dundas 9%, Grenville 6%, Leeds 5%. This immigration moved upstream following the development of the Lumber Industry, and the clearing up of new lands.

2. A WORD ON CONSERVATION

By Conservation I mean the preservation and the rehabilitation of our natural resources, mainly those directly connected with agriculture, namely: Soil, Water, Organic Matter, and Crops, whether field or forest crops.

(a) Soil—To protect it against *water* and *wind* erosion.

Gulley Erosion: Striking examples of gulley erosion can be seen at School Section No. 5, Bradley Creek, on the Lemieux road, in Plantagenet South Township, Prescott County; at School Section No. 10, near Pendleton, also in Plantagenet South Township, Prescott County; near School Section No. 18, west of Bourget, in Clarence Township, Russell County, and north-east of the County Forest, also in Clarence Township, Russell County. At L'Orignal, on the Bay road of the Domaine or "Seigneurie de L'Orignal" (last Seigneurie conceded by the French Government, and the only one situated in Upper Canada, or Ontario), sliding occurs along a shore of approximately two miles, extending from the Lighthouse to School Section No. 2. The lands abutting the bay are affected to the extent of 15% of their size. The road, along the shore of the Bay, had to be moved in three times during the last ten years. In

By Department of Public Works, Ottawa

Dredging the channel of the South Nation River, at the Village of Plantagenet.

1944, 67 different slides occurred on this waxy type of clay soil, on a depth of about 25 feet, and in spots as wide as 80 feet.

Wind Erosion can be observed in the Village of Curran, in Plantagenet North Township, Prescott County; at Baker's Corner, north of Pendleton, also in Plantagenet North Township, Prescott County, and on the Grant road, near the County Forest, in Clarence Township, Russell County.

(b) WATER—to control and regulate surface water and to maintain ground water at a favourable level in the soil.

(c) ORGANIC MATTER—To conserve organic matter by establishing proper methods of cropping and reforestation, and by adopting a happy balance between forest cover and cultivated land.

3. THE NEED OF CONSERVATION

Is there any need of Conservation? We have floods, soil erosion, drought (1941, 1944), crop failures, and our land is denuded of trees. Where is our timber wealth? Where is our lumber industry? What has

happened to our numerous saw-mills? They have all disappeared with the woods. What more can we say?

We have deforested our land to an extreme limit, and at an excessive rate, without proper steps being taken, at that time, to replace, even on a small scale, what was being taken away from the forest.

[a] Extent of Deforestation in the Nation River Drainage Area:

1. 654,700 acres, or 71.5% is cleared land and is used for agricultural purposes.
2. 65,000 acres, or 7.2% is wooded land producing forest products.
3. 195,300 acres, or 21.3% is largely slash, waste and low land which is non-productive at the present time.

915,600 acres 100%

The Nation River Watershed drains a large percentage of the best agricultural land in Eastern Ontario. Unfortunately 21.3% of its total area, or 195,300 acres are made up mostly of slash land which is unproductive. I may add that even some of the cleared lands, that are classed in the marginal and submarginal group, should be given back to the forest. When one considers the revenue which would eventually be derived through reforestation, it places heavy responsibility on this generation, especially on its leaders.

[b] Rate of Deforestation:

Let me quote some figures:

Number of acres of each class of land based on the Assessor's Roll in the National River Valley for the years 1901 and 1934—

Cleared Land	Wooded Land	Swamp, Slash, etc.	Total
	Year 1901		
543,000	252,000	119,200	915,600 acres
59.5%	27.5%	13%	100%
	Year 1934		
654,700	65,600	195,300	915,600 acres
71.5%	7.2%	21.3%	100%

Please note that the wooded land during that period of *thirty-three years* has decreased by 20.3%, as against an increase in slash land of 8.3%, and also an increase in cleared land of 12%.

In Russell County the decrease in forest land during the same period is from 58.5% in 1901 to 4.4% in 1934, or a difference of 54.1% of the total area of the County which was deforested, irrespective of forest fires.

4. WAS THERE ANYTHING DONE ABOUT CONSERVATION SO FAR?

Speaking of that part of the Nation River Valley that I know best, that is, Prescott and Russell Counties, I would mention the following projects:

By T. C. Lovell.

Dam and mill on the South Nation, at Spencerville.

[a] Drainage Schemes:

(1) The O'Brien Ditch ($60,000.00) drained part of the Alfred Peat Bog. This was undertaken by the O'Brien family. The object of this project was to put more land under cultivation. Instead of that, it simply encouraged farmers to burn more land, the unburned part of it being mostly used for the collecting of moss, and the manufacturing of peat fuel.

(2) The Cobb Lake Drainage Scheme ($60,000.00) reduced a large area covered by water to a tiny little creek.

(3) The Bearbrook Drainage Scheme ($135,000.90). The lowering of the bed of this stream has helped to drain land which was not used for agricultural purposes before.

(4) The Dredging of the Castor River ($80,000.00). Some work was undertaken along the Little Castor River, in Russell, Winchester and Mountain Townships.

(5) The Lowering of the River Bed of the Nation at Plantagenet ($150,000.00). To date, two strips of 80 feet wide and approximately 8 feet deep through solid rock have been taken away in the rapids in the Village of Plantagenet. The Public Works Department, at Ottawa, is actually preparing plans to dredge another strip of the same width, and possibly cut the rock underneath the C.P.R. bridge. Farmers located in the flats above Plantagenet have complained for years that the water was held too long in the bottle-neck of Plantagenet. Some *thirty-five years* ago, the Hager Dam was blown up at Plantagenet, to enable the water to run through at a quicker rate during the time of the flood in the spring. ($20,000.00 were given by the Federal Government to Albert Hagar, M.P., for his dam. He in turn took steps to blow it up.) The river is actually being dredged for exactly the same purpose.

The cost of all these schemes was approximately $500,000.00.

It is true that these projects have added to the area of land under production, and have enabled the farmers to sow at an earlier date the flooded parts of their farms, but they have considerably lowered the water level in the streams and in the surrounding soils, with ill effects on springs and wells and on the growing of crops, especially in years of low precipitation.

[b] Reforestation Projects:

(1) Rockland Plantation: In 1914, the late Senator W. C. Edwards, owner of large saw-mills in Rockland, planted, under the auspices of the Federal Commission of Conservation, 16,000 Red Pines and 20,000 White Pines on pasture fields, near the town of Rockland.

The White Pines were seriously affected by insects, but the Red Pines are showing very nicely, and, as a matter of fact, this plot is considered to be one of the best, if not the best in the Province of Ontario.

(2) Plantagenet Demonstration Woodlot: A small demonstration woodlot was established and planted in 1922 and 1923 near Plantagenet. It comprised an area of eleven acres, with 12,500 conifers, half Scotch and half Jack. The Scotch did not do well, but the Jack Pines are coming on very nicely.

(3) Waste Land Utilization: In 1926, a general compaign was put on in Prescott and Russell Counties inviting people to make a better use of their marginal and submarginal land –

1. For the growing of small fruits and vegetable crops for domestic canning purposes. Small domestic canning establishments, 135 in number, were started.
2. By reforesting privately or otherwise larger areas which could not profitably grow field crops.

By T. C. Lovell.

Dam at Chesterville, on the South Nation River.

(4) Committee on Reforestation: In 1927, to follow up this work, a committee on Conservation and Reforestation was appointed by the Counties' Council with Mr. Marshall Rathwell, Reeve of Cumberland, as Chairman, and myself as Secretary-Treasurer. Mr. Rathwell has been Chairman of the local committee for all these years, and he has been elected again this year for the 18th consecutive time. May I be permitted to compliment him, and to pay a public and a much deserved tribute to his contribution to Conservation and Reforestation, not only as Chairman of the local committee, but as Vice-President of Zone No. 5, and as 2nd Vice-President of the O.C.R.A., which position he still occupies.

(5) County Forest: In 1928, the Prescott and Russell County forest was organized with 1,200 acres. It has now reached the 8,000-acre mark, and it is our hope and ambition to keep it growing.

(6) Forestry Field Day: In order to popularize reforestation methods, a Forestry Field Day was held in Prescott and Russell, in the Fall of 1938. This was largely attended by local people and by delegates from surrounding Counties.

(7) Sea Sand Reed Experiment: In June, 1929, an experiment was undertaken to control blowing sand, in the vicinity of Curran, by sowing a plant named "The Sea Sand Reed" ("Ammophila Breviligulata"). Although slow in developing, this plant has proven effective in holding down blow sand. It is, however, of very little value to stock, either as pasture or as hay, because its texture is very coarse and woody.

(8) Protection of Catchment Basin of Springs: Reforestation of the catchment basin of springs feeding the Plantagenet Waterworks was inaugurated in 1939. Up to date, the Plantagenet Police Village has acquired *225 acres.* Already *25,000 trees* have been planted. Plans are being made to plant another 15,000 in 1945. Similar work has been undertaken to protect the Waterwork System of the Village of Bourget, and also the Waterwork System of the Village of Clarence Creek both in Clarence Township. Other projects are under way to shelter privately-owned waterwork systems for individuals as well as for groups of farmers.

(9) Other County Forests: In 1938, a second County Forest was opened up in Lanark County, and in 1940, a third County Forest, "The Limerick", was organized in Grenville County. The Lanark forest is not in the South Nation River area, but is within Zone No. 5. Demonstration woodlots were planted, to the extent of 200 acres, in Glengarry, Stormont and Dundas, for educational purposes.

TOTAL LAND UNDER REFORESTATION

The total acreage of land devoted to reforestation in the South Nation River Watershed is as follows:—

Prescott and Russell County Forest.	8,000 acres of which 3,000 have been planted.
Grenville County Forest.....	600 acres are located in the watershed, out of a total of 1,200 acres.
Private Planting.....	3,000 acres at normal spacing.
Total.....	11,600

It is estimated that not over 11,000 acres of non-agricultural land have been reforested during the past thirty years or so. This represents a little better than 5% of the total area unsuited to agriculture. *At that rate, it will take 570 years to finish the job.*

Courtesy of Mr. Frank Salter.

Farmstead isolated by flood of South Nation River. Scenes like this are often seen, in flood time near Cass Bridge.

Number of trees planted within the Nation River System:—

Private Planting	2,200,000 trees
Municipal Planting	800,000 trees
County Forests	2,724,500 trees
Total	5,724,500 trees

5. WHAT SHOULD BE DONE IN THE FUTURE

So far, Reforestation and Conservation projects have been carried on at random, in a haphazard way, and at the favour of local circumstances, opportunities, or leadership. In the future, work should be undertaken in a more systematic and aggressive way. Plans would have to be worked out, and steps taken to implement them. In other words, a complete survey of the Nation River Watershed should be made and developments drafted ahead, to ascertain that no mistakes will be made in their execution, and that the highest possible efficiency will be attained.

In this regard, two things strike me as *essential* and *urgent:*

1. *A happy proportion between forest land and crop land* should be established, taking into consideration that in agriculture, the size of a farm is less important than the intensity of its production.

2. *A thorough study of ground water should be made*, with a view of bringing up the water level in the soil to a proper height, by damming streams at strategical points.

This policy would help to keep up our wells and springs, and would bring up the water table to a point where it may be readily available to crops. It is useless for me to go into details, as those ought to be left to expert hands.

Let us hope that long overdue action will be taken, in the near future, to make the best possible utilization of land in the Nation River Valley, for the benefit and the comfort of all those concerned.

I thank you.

DISCUSSION

DR. J. H. MUNRO: This project, as given us by the speaker, is something that is rather intriguing from the point of view of comparison with the Ganaraska scheme which has already been surveyed, in that the Nation River, on which the population of portions of eight counties in the most easterly part of Ontario depend, passes through a rich agricultural district, low flat land, with very few hills and ultimately finds its way into the Ottawa River. Over a great period of years the forests have been mined in these counties; have been denuded of trees. The result is now being shown in the agricultural community by the falling of the water table and lack of water in the river on which the whole population depends.

It is a problem which will have to be approached from a different point of view from that of the Ganaraska, in having the Nation River Valley surveyed, in that a number of thickly populated villages are in the area and all of them depend on the river for their water supply, and in some instances are large users of it at some seasons of the year. One is Chesterville where the Nestle's Food Products is located and which depends on the Nation River for its water supply and at times that company has to go upstream and pump from deep holes in order to get a sufficient supply.

Now, if anything brings home the need for reforestation, I think the best example in Ontario is in the Nation River Valley and I hope at this Conference that some action will be taken with a view to altering the conditions of flood in spring and drought in the summer.

MR. KING: May I add something to what Mr. Munro has said. I happen to be connected with the firm in Chesterville requiring this water. I have been in Chesterville twenty-five years, in charge of the plant and I have had a chance to observe the decreasing amount of water. It has been going down each year to a point where the situation has become so serious that in 1941 we pumped water from above the town to our pool from August 9th to October 14th. This year we had to start on October 6th and we pumped until December 5th when the storm drove us out of the river.

Our company supplies a market for 450 of the best patrons in Ontario in the milk line, and it is very vital to them as well as to ourselves, that something be done in and around Chesterville.

MR. G. H. BARKLEY: I quite agree with Dr. Munro when he says the Ganaraska and the Nation watersheds are not alike. We have our towns and we have all our sewers which empty into the Nation River, and I tell you it is in terrible shape. If it hadn't been for the Nestle Company pumping water down there last summer we wouldn't have had fire protection.

MR. THOMAS: I would like to compliment Mr. Larose on the paper that he has presented to-day. I would like to have heard him comment, if time had permitted, on the types of fish that are rapidly disappearing. This was also a splendid means of attracting tourists. That feature too has disappeared.

I would like to endorse Dr. Munro's suggestion as to the type of survey to be done in that section of the country.

11

"CONSERVING SOIL AND WATER ON THE FARM"

L. R. WEBBER
Soil Specialist, O.A.C. Guelph

TO conserve soil and water on a farm, the practices and the methods that may be successfully adopted are somewhat dependent upon the early treatment of soil and native vegetation. Our thinking immediately goes back to the pioneer days when little thought was given to conserving our natural resources whose supply seemed to be unlimited. Had we been on hand when areas were opened for settlement and knowing what we profess to know now, a policy of restricted and controlled clearing of land might have been enforced. Perhaps our farming communities now labouring under critical losses of soil and water would have been maintained as permanent forest land acting as a supply house of wood products and a storehouse of water.

The unlimited supply of our resources did not materialize; we denuded land at an amazing rate and cultivated the life out of our soils. Little wonder that a national interest in the conservation of our natural resources is reaching such proportions. Our farmers are deeply concerned about the decreasing yields of crops, nutritionists worry over the quality of the produce, foresters seek more woodland, biologists relate the disappearance of stream and lake fish, others record lowering water tables, abandoned farms and unsatisfactory living conditions.

After trying to achieve partial relief through other avenues of approach, we are coming to realize that most of the trouble traces back to the handling of the soil. The Ganaraska report states that "soil data is basic to any present or proposed land use problem" and Dr. R. C. Wallace in an introduction for the same report says that "conservation is the survey of all resources leading to multiple purpose rehabilitation." Are we guilty of "greedy, careless and unintelligent farming methods?" Each man leaves his imprint on the soil whether he steals from it or cherishes it. If we are able to introduce measures that effectively prevent and control soil erosion and adequately conserve rainfall on the farm, we have accomplished a great deal but that is not the whole of conservation. We are reminded of the six blind men of Indostan who went to see an elephant. If by conserving soil and water on the farm we then announce our accomplishments as Conservation, we are likened unto the blind man who grabbed the tail and said the elephant is like a piece of rope. The many phases of conservation are interdependent on

By U.S. Soil Conservation Serv

A wise land use policy. The steepest part of the hill is left in woods with permanent pasture on the longer slopes too steep for rotation cropland. The regular cropland is strip-cropped to conserve soil and water.

each other; no one phase will enjoy a sustained and fruitful life at the expense of another.

WHAT IS CONSERVATION FARMING?

Conservation farming is common sense farming so that we prevent and control soil erosion and conserve rainfall. Such farming requires the proper use and treatment of every acre on a farm in accordance with the individual needs and capabilities. It is a matter of using soil resources to produce all that can be safely produced and maintaining them in good condition for future use. If we believe in and practise wise land use, then erosion-inducing crops would not occur on soils unprotected against erosion. We would plan the use of our land so that farm crops would not be grown where grass or trees would be the better land use.

Conservation farming is a combination of practices and methods whereby a farmer is able to conserve soil and water and at the same time increase the production and improve the quality of his crops. Conservation farming on many thousands of farms in the United States has resulted in an average increase in per-acre yields of at least 20 per cent. This has been accomplished with very little additional labour, fuel, time, money or machinery. Recent studies have shown that a greatly increased production of nutritious feed for stock can be obtained by growing wheat instead of corn in much of the corn belt. Corn being a tilled crop induces erosion on the slightest slope while wheat being a drilled crop causes relatively little erosion. The selective nature of erosive forces has been proven by analysis. The soil washed off contained 4.7 times more organic matter, 5.0 times more nitrogen, 1.4 times more potash, 3.0 times more phosphorus and 2.0 times more calcium than what existed in the soil. Other numerous experiments have shown that an eroded soil cannot be restored to its original productivity. While these findings are American in origin they will apply to Ontario in varying degrees.

Simple contouring of a crop for cultivation. The small furrows left by the cultivator catch and hold the water which would run downhill and cause serious erosion if cultivated down the slope.

By U.S. Soil Conservation Service.

By U.S. Soil Conservation Service.

Strip-cropping is beneficial on long uniform slopes. Conservation of power is also possible because the harvesting is done on the level rather than going up and down hill.

They also indicate what we may reasonably expect with regard to quantity and quality of produce. If our methods of farming, handed down through several generations, still continue then tradition will have to be sacrified for the improvement of agriculture. If these methods are depleting our soils of essential plant food, how can our crops contain the necessary minerals in adequate amounts to support healthy vigorous people?

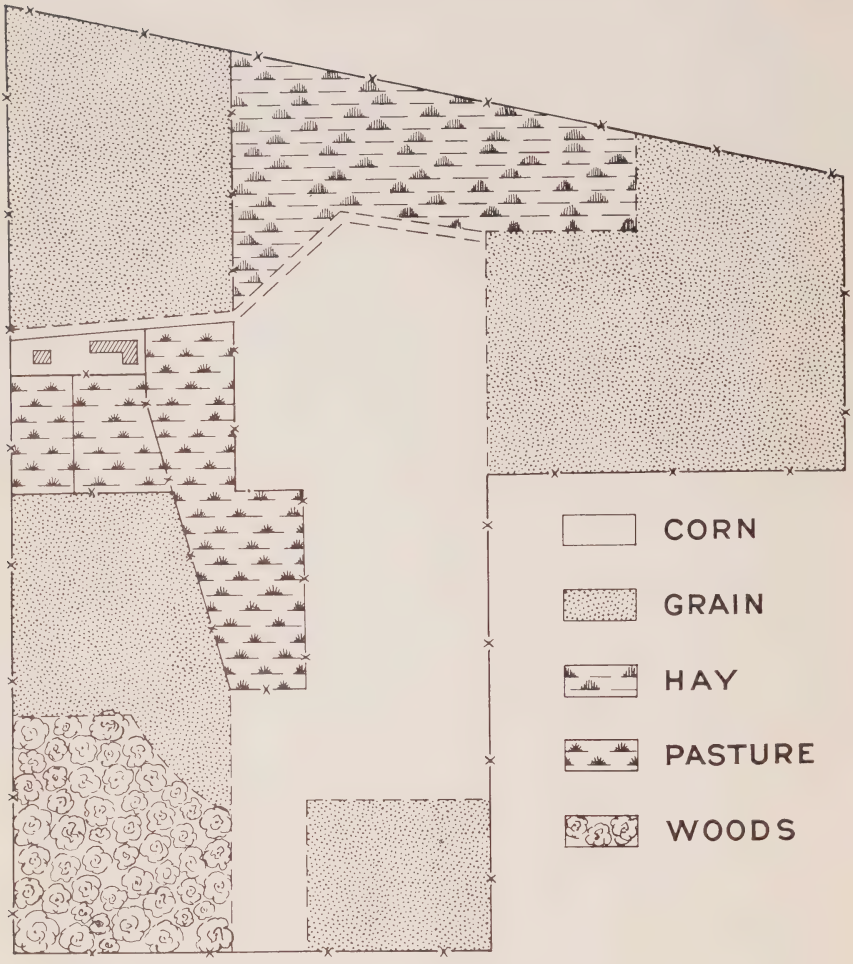
Conservation farming aims at keeping as much water as possible on sloping lands and removing the excess without causing unnecessary damage. Conservation is a science whose principles are found in the Laws of Nature. There is no appeal or amendment to these laws; we must learn to co-operate with them. One of the fundamental laws of nature is that water tries to seek its own level and in so doing will run down hill on any farm. If this surface water moves unchecked the

carrying capacity is increased 64 times as the velocity is doubled. The speed also increases as the volume of water flows in a confined area such as a rill or gully. Conservation farming provides several control measures so that much of the rainfall soaks into the soil where it is most needed while the excess is carried off the slopes by grassed waterways and delivered into streams relatively free of sediment. These control measures are effected largely through the type of crops found on the different soils. Where good covers of dense vegetation and forests have been established and maintained, as on steep erodible land, there is very little more required in the way of erosion control. Soil and water losses are so small as to be negligible. At Zanesville, Ohio, the erosion experiment station has grown corn continually on a regional soil type for the purpose of measuring soil and water losses. Under such a practice the soil loss has been 94.6 tons per acre, per year, and the water loss has been 42.4 per cent of the total precipitation. At many places in the States conservation farming lessens the soil and water loss regardless of how long or how heavily it rains and regardless of freezing and thawing.

Conservation farming puts first things first by attending to the needs of the soil. Determining the needs of the soil is the prime requisite in developing a successful programme of conservation for farmlands. We require detailed soil surveys showing soil type, degree of erosion, slope and present land use usually plotted on large scale aerial photographs. From this information the land use capability classes are formed to show the suitability of land for a specified use. Capability answers such questions as: Is the land suitable for the production of crops? Can it be used safely for tillage without causing soil erosion? Is its safe and permanent use limited to the production of permanent vegetation? Having obtained the detailed inventory of the soils on the farm and found reasonably sound answers to the questions, the farmer is provided with a programme of conservation designed to ensure adequate control of soil and water losses on his farm. The individual programme is based on the particular requirements of the soil and such effective and special control measures as are deemed applicable.

CONSERVATION METHODS

The task of planning farms is a serious and difficult obligation. A successful plan of conservation depends on the ability of a farm planner to co-ordinate the basic soils data with agronomy to give a suitable type of farming. A planned farm has a cropping system and other conservation measures based on the capability of the soil, not what the planner has a fancy for, not on temporary economic considerations. The farm planner endeavours to work out, in co-operation with the farmer, a programme particularly adapted to his farm, that is acceptable, that

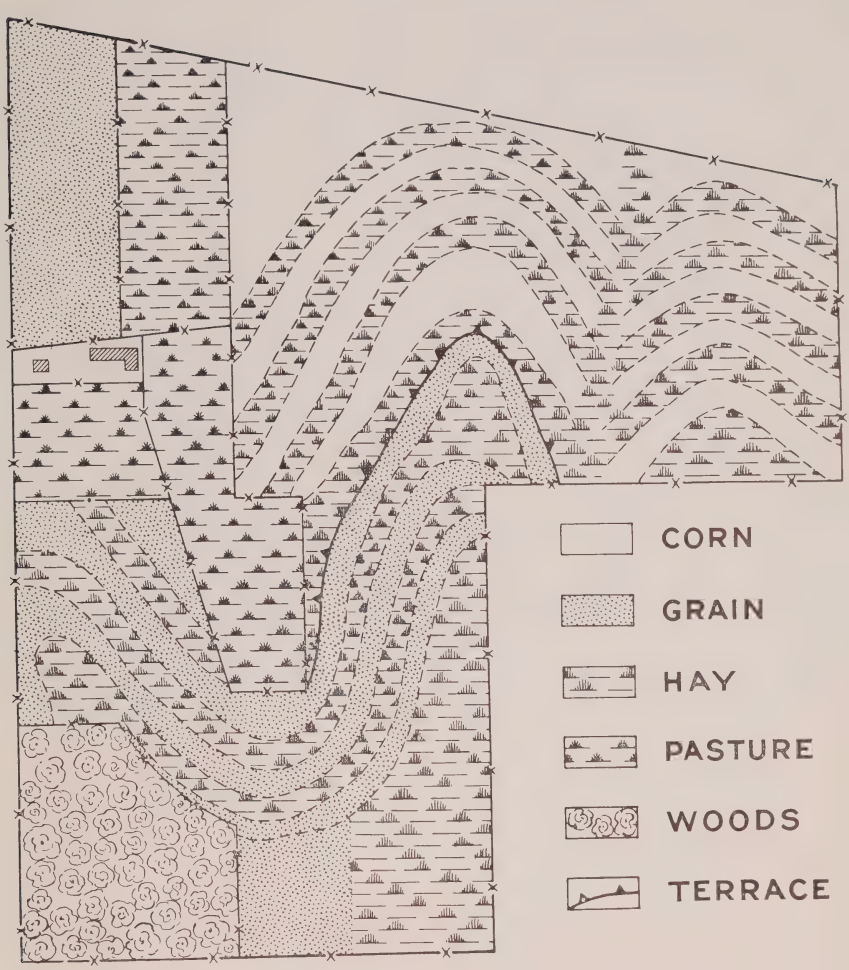


Map of a farm before planning.

provides maximum income and production, and that maintains adequate control over soil and water losses.

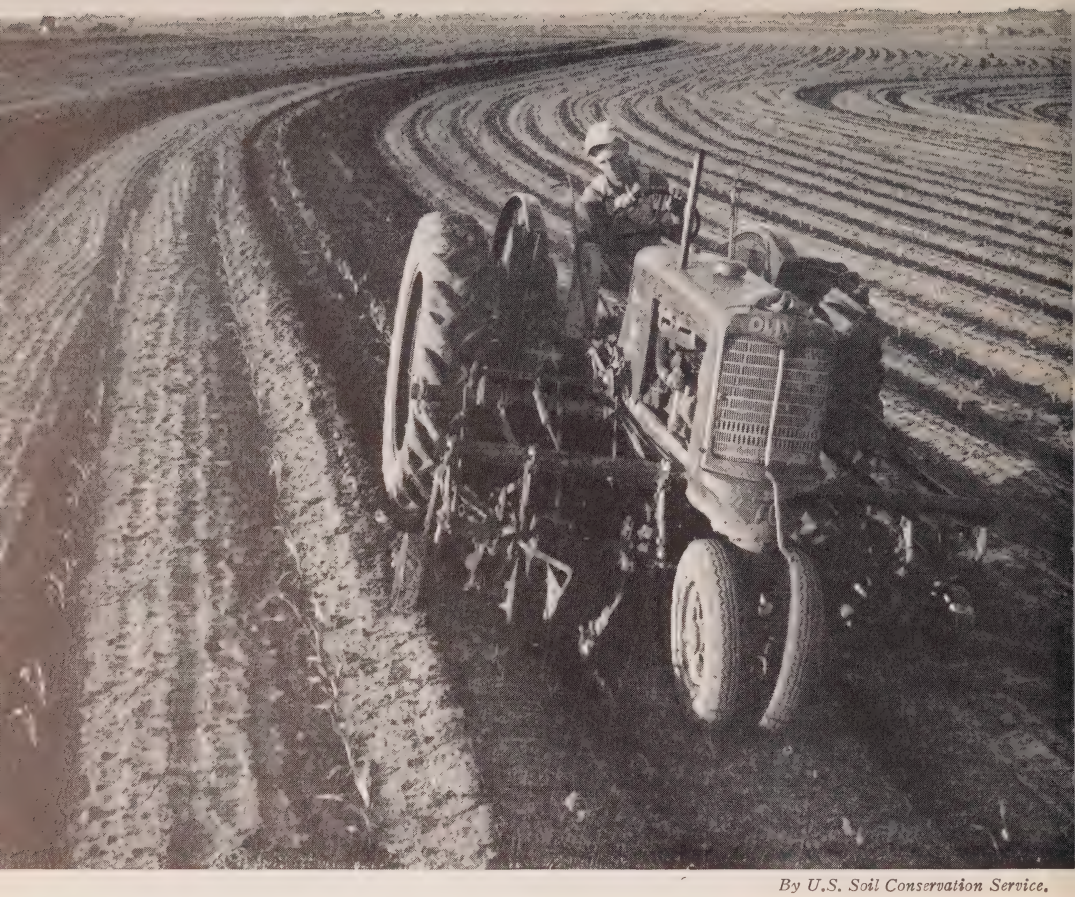
The cropping land on a farm usually requires the greatest amount of planning. Crop rotation and soil fertility are given special emphasis. Soil-building crops like legumes and grasses are included in good rotations; the acreage of soil-depleting crops, cereal grains, corn, potatoes, etc., is governed by the capability of the land. Associated with crops and crop rotation is soil fertility. A poor soil cannot produce sufficient cover

AFTER PLANNING



Map of the same farm after planning.

to afford sufficient protection against driving rains. A soil, low in organic matter, has low absorptive capacities with the result that the water runs off in large amounts rather than soaking in. Maintenance of soil fertility is essential for the control of erosion. It makes little difference what conservation practice is used; unless soil fertility is maintained—the soil cannot be conserved. Are not these measures just plain examples of practices any good farmer would use whether he calls it conservation or common sense?



By U.S. Soil Conservation Service.

Using a tractor to cultivate corn on a contour terrace.

In addition to crop rotation and soil fertility maintenance, cropland frequently requires special methods in conservation. Contour farming applies to the practice of plowing, planting and cultivating cropland on the level around slopes. This is an excellent method for reducing soil erosion damage, loss of rainfall and increasing crop yield. It is a great improvement over the old method of farming in straight rows regardless of slopes. By farming on the contour, each ridge and furrow left by tillage implement helps keep the rainfall on the slopes.

Grassed waterways help prevent and control gully erosion; all main drainageways in cultivated fields should be kept permanently in sod. They should be wide enough to prevent the water overflowing onto cultivated land. Frequently hay is harvested from these waterways.

Strip cropping is a plan of alternating strips of grain or row crops with hay or meadow. The most common practice is to have the strips on the contour providing the most effective way of saving soil. A meadow

By U.S. Soil Conservation Service.

A farmer and his son inspect a well-formed terrace, built on gently sloping cropland. The terrace is perhaps eighteen inches high with a base of fourteen to twenty feet. When properly built a terrace does not interfere with cultivation or harvesting. All farm operations are with the terrace rather than across it.

strip should be between each two cultivated strips. The width of the strips varies according to soil type, steepness of slope and the crops grown.

Terracing of moderately sloping land is a more complete measure for controlling erosion. Terraces are broad-based ridges built approximately on the contour. The channels along terraces ridges act like eavetroughs to carry surplus water off the field. A suitably protected outlet should be provided to carry the surplus water before the terraces are built. Most terraces are maintained at a height of 18 inches. All farming operations are with the terrace rather than across it.

Conservation on the farm includes cropland, woodland and all pasture land. The proper management of woodland contributes much to the control of run-off and to the "flattening out" of the peak flow

By U.S. Soil Conservation Service.

Contour cultivation on the level, around the slope, is here supported by strip-cropping with alternating bands of close-growing erosion-resistant crops and cultivated row crops.

from melting snow. A fire in the farm woodlot is an ever-present danger to the crops, buildings, and the trees themselves. Grazing of woodland tends to destroy the forest litter, reducing the absorptive capacity and increasing the amount of run-off. Many Ontario farmers would welcome expert advice on the proper care of their woodlots and some knowledge on selective cutting for maximum production of fuelwood, lumber and timber. Where the proper land use for an area, large or small, is woodland, some thought must be given to selection of trees, methods of planting and subsequent care.

There will be variable amounts of land to be retired from regular cultivation and left in permanent grassland for pasturing. Generally, on such land, the soil is very susceptible to erosion or too poorly drained for most farm crops. Under such a variety of conditions of temperature and moisture supply the selection of adequate pasture mixtures is most important not only for maximum production but for good pasture during July and August. In Ontario, the Pasture Committee has demonstrated the value of good pastures, the principles of care and management and the selection of adaptable seeding mixtures.

It would be grossly inaccurate to suggest that conservation can be put into effect immediately or to infer that we can farm just as before.

For some there may be a slight cost, for others it involves changing the farm pattern, and still others may decide it is necessary to adjust their livestock programme. What may the farmer reasonably expect in return for some diligent stewardship of the land? To me, the highest ideal a farmer can strive to attain is to so operate his business that by a wise and faithful stewardship of soil, he leaves his farm to his successor as productive as is humanly possible. This can be done when the farmer, aided by society, actually cherishes his land.

Conserving soil and water on the farm is not the all-in-all or the great panacea of our land problems but until better methods are proven conservation has much to offer. Regardless of our business or profession every individual has a duty and obligation in aiding our farmers to live up to the XI Commandment of Dr. W. C. Lowdermilk's, Assistant Chief of the U.S. Soil Conservation Service.

If this water, resulting from one storm, had been allowed to run downhill unchecked, serious loss of topsoil and water would have resulted. The water that has been caught by this terrace can flow safely away by means of a grassed waterways.

By U.S. Soil Conservation Service.

"Thou shalt inherit the holy earth as a faithful steward, conserving its resources and productivity from generation to generation. Thou shalt protect thy fields from soil erosion and thy hills from overgrazing by thy herds, so that thy descendants may have abundance forever. If any shall fail in this stewardship of the land, his fertile fields shall become sterile stones and gullies, and his descendants shall decrease and live in poverty or vanish from the face of the earth."

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REPORT OF THE RESOLUTIONS COMMITTEE

Professor R. F. Legget
Department of Civil Engineering, University of Toronto, Toronto

I have here a number of resolutions, and several matters not contained in resolutions which are listed as recommendations to be submitted for such action to be taken as is necessary, and then to be presented, together with the five resolutions of this meeting, with the requestion that they be passed to the Minister of the Department of Planning and Development, to be brought to the attention of the Premier of the Province.

(The following resolutions were then presented, moved by the chairman of the resolutions committee, seconded by an attending delegate and passed by the conference.)

Whereas it has been reported that the Ganaraska Report is already out of print, and *whereas* this Report provides such vitally important information for the furtherance of the conservation of natural resources in Canada, and in Eastern Ontario in particular, therefore be it resolved that the proper authorities be requested to have the Report reprinted as soon as possible, in adequate supply.

Whereas the proceedings of this Conference have included much invaluable information relative to the future well-being of Eastern Ontario, and *whereas* this information should be circulated as widely as possible, therefore be it resolved that the Department of Planning and Development be requested to have printed and distributed a record of the Conference.

Whereas the maintenance of adequate forest cover is essential to the future well-being of Ontario, and *whereas* the uncontrolled cutting of private woodlots, the fire hazards from private woodlots, and the waste occasioned by improper cutting of trees on all land, therefore, be it resolved that the Government of Ontario be requested to study the possibility of immediately instituting adequate control over the cutting and protection from fire of all growing timber throughout Ontario.

Whereas the conservation and rehabilitation of renewable natural resources can only proceed on the basis of adequate knowledge of the present state of these resources; and

Whereas it has been demonstrated beyond all doubt that immediate attention to the conservation to natural resources in Ontario and particularly in Eastern Ontario, is imperative; and

Whereas such conservancy and rehabilitation work is ideally suited for giving satisfactory employment to many members of the Armed Forces upon their discharge from the nation's service;

Therefore be it Resolved the Government of Ontario be urged with the full and unanimous support of this conference to institute as soon as it is practically possible:

(a) As many of the essentially necessary regional surveys as practicable such as the Nation River Valley, and the project of the Lennox and Addington County Council for the Napanee River; and

(b) Research and training facilities in relation to game and fur-bearing animals in Ontario; and

(c) A corresponding ground water survey in Eastern Ontario to that urged for South-western Ontario at the preceding London Conference.

That in view of the success of this Conference on Conservation in Eastern Ontario, and of the enjoyment and appreciation of all the proceedings by all those in attendance,

Therefore it is now unanimously resolved by the conference in final session assembled that its thanks be presented to Queen's University for its hospitality and its welcome, to the Department of Planning and Development for initiating, arranging and financing the conference, and to all those who have contributed to its success, and in particular to the Local Organizing Committee, Principal R. C. Wallace of Queen's University, the Honourable Dana Porter, Minister of the Ontario Department of Planning and Development, Dr. G. B. Langford, Director, and to Mr. A. H. Richardson.

HONOURABLE DANA PORTER

In closing this Conference I would like to say we appreciate very much the support we have had from you. I know that you have learned much at this Conference. So have we, and we hope to learn more in promoting the steps that are to be taken following this Conference and I am glad to accept the resolutions and recommendations which have been passed here, and which will be a guide to my Department.

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